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# CCP Transuranic Waste Certification Plan

## CCP-PO-002, Revision 2

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## 1.0 INTRODUCTION

The Central Characterization Project (CCP) is tasked with characterizing and certifying transuranic (TRU) waste for disposal at the Waste Isolation Pilot Plant (WIPP). Accordingly, the CCP must comply with the *Contact-Handled (CH) Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant* (WIPP WAC), DOE/WIPP-069. The WIPP WAC establishes the specific physical, chemical, radiological, and packaging criteria for acceptance of defense TRU waste shipments at WIPP. The WIPP WAC also requires that the CCP produce documents, including a certification plan, that describe their program for managing TRU waste and TRU waste shipments before transferring waste to WIPP. The CCP must also ensure that its TRU waste destined for disposal at WIPP meets requirements for transport in the Transuranic Package Transporter-II (TRUPACT-II). The U.S. Nuclear Regulatory Commission (NRC) establishes the TRUPACT-II requirements in the *Safety Analysis Report for the TRUPACT-II Shipping Package* (TRUPACT-II SARP).

The CCP may provide its services to a site by contracting directly with that site. If this is the case, the scope of services provided by CCP are specified in a Statement of Work (SOW) issued by the site. The SOW also specifies health and safety requirements, quality requirements, and other requirements specific to that site. A site-specific interface document may also be prepared which provides more detail on the site-CCP interface.

The site has general management oversight responsibility for work performed by the CCP at the site. The site is responsible for ensuring that CCP conducts its activities in compliance with site requirements.

Figure 1-1 illustrates the hierarchy of regulatory requirements for TRU waste characterization, certification, and transportation and reflects the flow-down of requirements from higher-level documents to site-level program documents and implementing procedures. To ensure that future changes to the WIPP WAC and other relevant requirements documents are appropriately reflected, this *CCP Transuranic Waste Certification Plan* (hereinafter referred to as the WCP) will be reviewed at least annually and updated as necessary.

This WCP establishes the programmatic framework and criteria within which the CCP ensures that CH TRU wastes can be certified as compliant with the WIPP WAC. This WCP does not address remote-handled (RH) defense TRU forms. This WCP includes the following sections:

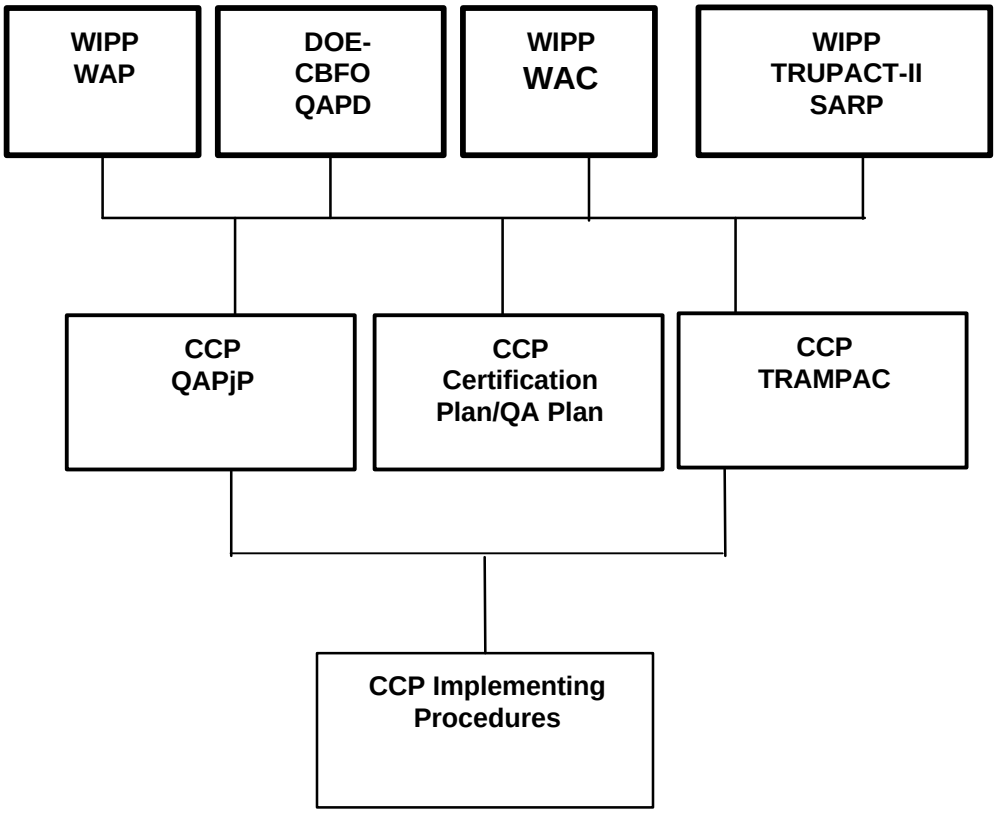
- Section 2.0, "Organization of the CCP," describes the interaction between the characterization, certification, and transportation personnel, and lists the responsibilities of key CCP officials.

- Section 3.0, "Compliance Plan for WIPP WAC," describes CCP activities and specific documents that implement and verify compliance with each requirement.

- Section 4.0, "Quality Assurance Plan," describes how the CCP complies with the *Quality Assurance Program Document* (QAPD) and the WIPP WAC.

This WCP and associated QA Plan (Section 4.0), the *CCP Transuranic Waste Characterization Quality Assurance Project Plan* (QAPjP; CCP-PO-001), and the *CCP TRUPACT-II Authorized Methods for Payload Control* (TRAMPAC; CCP-PO-003), establish the programmatic framework for the CCP's waste characterization, certification, and transportation activities. These documents are submitted to the Carlsbad Field Office (CBFO) for review and approval.

**Figure 1-1. CCP Document Hierarchy for TRU Waste Characterization, Certification, and Transportation**



# 2.0 ORGANIZATION OF THE CCP

The responsibilities for TRU waste management of the CCP are distributed within various organizations. This section identifies the organizations involved in the CCP and describes the responsibilities of and interactions between these organizations.

## 2.1 Organization and Responsibilities

Figure 2-1 is a functional organization chart pertaining to TRU waste characterization and certification activities at the CCP. The following subsections identify the organizations that oversee the CCP and describe the roles and responsibilities of key positions within the CCP charged with implementing the requirements defined in this WCP.

The DOE-CBFO Manager and Assistant Manager for the Office of National TRU Program (NTP) provide overall policy direction for the CCP.

### 2.1.1 DOE-CBFO Quality Assurance Manager

The DOE-CBFO Quality Assurance Manager provides independent oversight of the CCP and approves this WCP.

### 2.1.2 CBFO SQS Waste Certification Manager

The CBFO SQS Waste Certification Manager oversees the CCP and approves this WCP.

### 2.1.3 Central Characterization Project (CCP) Manager

The Central Characterization Project Manager is responsible for the day-to-day management and direction of CCP activities. The CCP Manager is responsible for :

- Ensuring successful CCP/site interface
- Ensuring CCP plans and operations are coordinated, integrated, and consistent with DOE-CBFO programs, policies, and guidance
- Coordinating CCP activities and functioning as principal point of contact with DOE/CBFO and other regulating agencies
- Reviewing and approving this CCP WCP

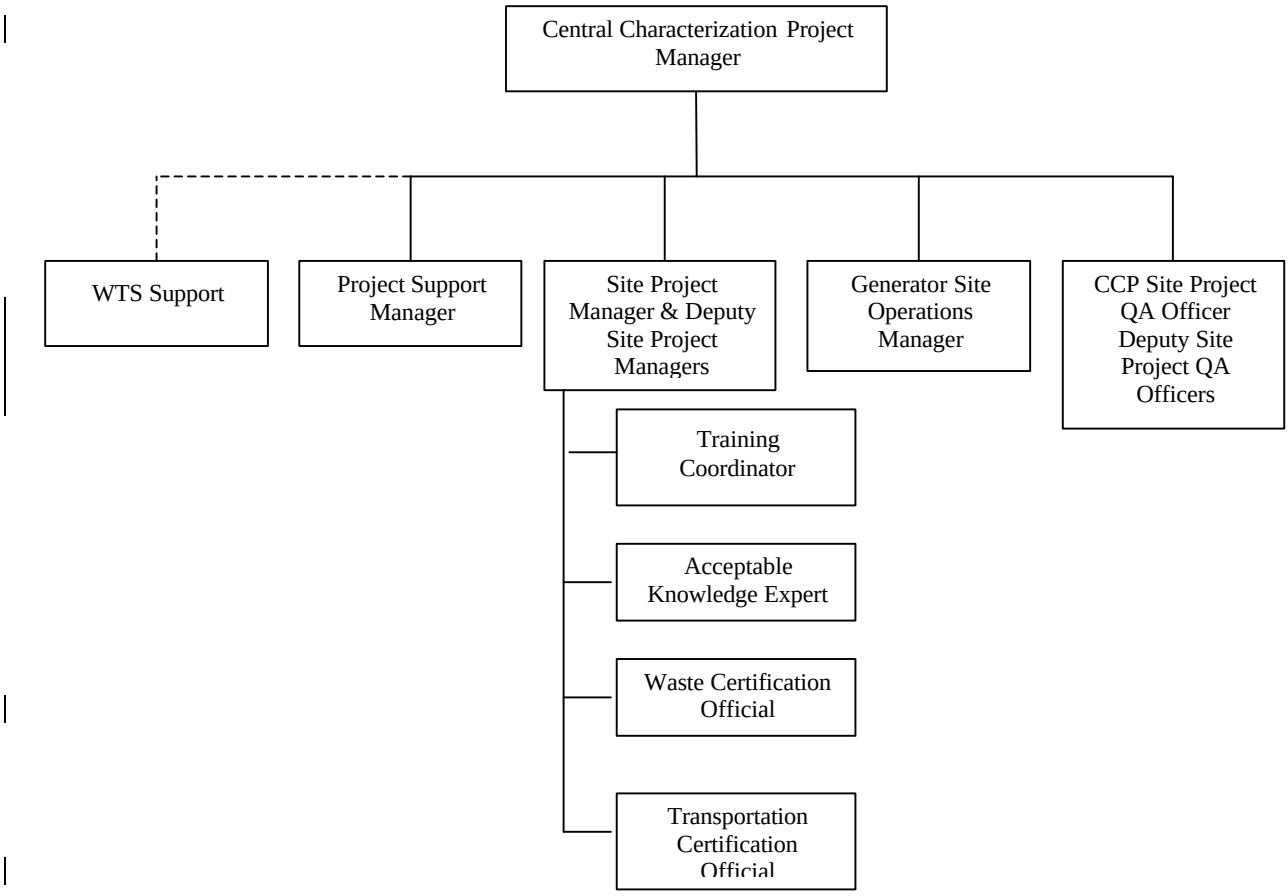
### 2.1.4 CCP Site Project Manager

The Site Project Manager (SPM) is the principal point of contact with DOE (including CBFO and NTP) for technical activities associated with TRU waste. The SPM coordinates with the CCP waste certification official (WCO) and transportation certification official (TCO) and oversees CCP activities to ensure that TRU waste is characterized and certified compliant with WIPP requirements. Specific responsibilities assigned to the SPM include the following:

- Reviewing and approving the CCP WCP.
- Developing, maintaining, reviewing, approving, and implementing CCP procedures and plans.
- Scheduling revisions and distributions of CCP procedures and plans and forwarding these documents (if significantly revised) to DOE-CBFO for review and approval before implementation.
- Ensuring CCP personnel receive appropriate training and are properly qualified.
- Obtaining AK information from waste generators regarding U.S. Environmental Protection Agency (EPA) hazardous waste codes.
- Assigning additional EPA hazardous waste codes to TRU waste on the basis of analytical results, as applicable.
- Reviewing and approving the interface documents.
- Waste selection and tracking.
- Halting characterization or certification activities if problems affecting the quality of certification processes or work products exist.
- Validation and verification of characterization data.
- Reconciling verified data with data quality objectives (DQOs).
- Evaluating and reconciling AK information with characterization data.
- Preparing and submitting SPM Data Validation Summaries, Waste Stream Profile Forms (WSPFs), Characterization Information Summaries, Waste Stream Characterization Packages, and quality assurance/quality control (QA/QC) reports to DOE-CBFO.

The SPM may delegate any of these activities to another individual; however, the SPM retains ultimate responsibility for ensuring that CCP certification requirements are met.

## Figure 2-1 CCP Functional Organization Chart



### 2.1.5 CCP Site Project Quality Assurance Officer (SPQAO)

The SPQAO provides QA oversight and planning for TRU waste characterization and certification, verifies the implementation of the QAPjP and the QA requirements of the WCP, and provides day-to-day guidance to CCP staff on quality-related matters. The SPQAO has the authority to stop CCP work activities if quality is not assured or controlled. The SPQAO's specific responsibilities include the following:

- Reviewing and approving CCP procedures and plans including this WCP.
- Reviewing and concurring with Westinghouse TRU Solutions (WTS) procedures used for CCP support to assure CBFO QAPD requirements are met.
- Maintaining the CCP Procedures Matrix and identifying CCP and WTS procedures used in CCP activities to meet the requirements of the CBFO QAPD.
- Coordinating and participating in internal and external audits and assessments to verify compliance.
- Tracking compliance and evaluating trends in compliance with QA objectives (QAOs)
- Performing assessments of testing, sampling, and analytical facilities.
- Tracking and trending CCP nonconformances and corrective action reports (CARs).
- Verifying CCP corrective actions.
- Validating and verifying data at the project level.
- Submitting semiannual and other QA/QC reports to the SPM and DOE-CBFO.
- Coordinating responses to CCP nonconformance reports (e.g., NCRs) generated by CBFO or other external assessment organizations.
- Reviewing and approving supplier and subcontractor QA plans.
- Reviewing interface documents.
- Providing guidance to all CCP organizations concerning identification, control, and protection of QA records.
- Comparing VE and radiography data and calculating miscertification rates.
- Stopping work if quality is not assured or controlled.
- Providing day to day guidance on quality related matters to project staff.

The SPQAO may designate one or more individuals to perform the above functional responsibilities, but retains ultimate responsibility for assuring compliance with CCP Quality Assurance requirements.

### 2.1.6 Facility Quality Assurance Officer (FQAO)

The FQAO is responsible to perform data generation level reviews of waste characterization data. Specific duties and responsibilities include the following:

- Ensuring that batch data reports are complete
- Ensuring that sampling and analytical QC checks were performed
- Verifying that QAOs have been met
- Ensuring that instrument performance criteria have been met
- Verifying that QA documentation for batch data reports is complete
- Verifying and validating that characterization results meet the project QA/QC requirements.
- Documenting conditions adverse to quality and nonconforming conditions such as data that does not meet the QC requirements.

### 2.1.7 CCP Waste Certification Official (WCO)

The CCP WCO is responsible to review data and information necessary to document TRU waste payload containers prepared for shipment to WIPP meet specified criteria. The WCO coordinates activities related to waste certification. Specific duties and responsibilities of the WCO include the following:

- Certifying that waste packages and waste shipments meet WIPP WAC requirements.
- Interfacing with the SPM, TCO, and SPQAO on matters related to waste characterization and certification.
- Stopping waste certification activities if problems affecting the quality of certification processes or work products exist.
- Ensuring that certification data entered into the WIPP Waste Information System (WWIS) are accurate and demonstrate the acceptability of the waste for transport to and disposal at the WIPP.
- Reviewing the applicable CCP plans and procedures and any other waste certification-related documents.
- Reviewing this WCP.
- Preparing responses to deficiency reports.

The WCO may designate one or more individuals to perform these responsibilities.

### 2.1.8 CCP Transportation Certification Official (TCO)

The Transportation Certification Official (TCO) documents and certifies that payload containers and assemblies to be transported meet the requirements CCP-PO-003, *CCP TRUPACT-II Authorized Methods for Payload Control* (TRAMPAC). Specific responsibilities of the TCO include the following:

- Reviewing the applicable CCP transportation plans and transportation procedures.
- Interfacing with the SPM, WCO, and SPQAO on matters associated with waste transportation.
- Reviewing and maintaining the CCP TRAMPAC.
- Ensuring that data used in completion of the transportation documents is accurate and demonstrates that the waste is acceptable for transportation.
- Preparing and signing Payload Container Transportation Certification Documents (PCTCDs).
- Preparing and signing Payload Assembly Transportation Certification Documents (PATCDs).
- Assisting SPQAO with preparation of responses to deficiency reports in transportation matters.
- Ensuring that the transportation data entered into the WWIS are accurate and demonstrate that waste is acceptable for disposal at WIPP.
- Reviewing the interface documents.
- Halting transportation certification activities if problems affecting the certification or work process exist.

### 2.1.9 WTS Quality Assurance Manager

The WTS Quality Assurance Manager is responsible for providing support to the CCP. Specific responsibilities include:

- Performing independent assessments of CCP activities.
- Providing inspection services support for procurements, including source inspections.
- Providing support for training and qualification of CCP nondestructive examination (NDE) and inspection personnel.
- Maintaining the WTS QA program in compliance with CBFO QAPD requirements.

# 3.0 COMPLIANCE PLAN FOR WIPP WAC

This section describes how the CCP complies with the requirements of the WIPP-WAC associated requirements contained in the WIPP Hazardous Waste Facility Permit as implemented by the CCP QAPjP, and the EPA environmental compliance requirements established in the 40 CFR 191/194 Compliance Certification Application.

## 3.1 Organization of Requirements

WIPP WAC requirements are organized under six major categories: container properties, radiological properties, physical properties, chemical properties, gas generation properties, and data package contents. Sections 3.2 through 3.7 correlate with the organization in the WIPP WAC for CH TRU waste requirements and identify methods of compliance to meet each requirement. Procedures that implement the process controls, techniques, tests, and other actions to be applied to each TRU payload container, waste stream, and shipment are also identified. Waste shipped to WIPP must comply with the most restrictive of the CH TRU requirements established in the WIPP WAC. Therefore, only the most restrictive requirements are described in this section. Revisions of requirements in referenced documents controlled by agencies or organizations other than Department of Energy (e.g., EPA, New Mexico Environment Department, and NRC) shall have precedence over values quoted in this WCP. Changes incorporated in future revisions of the WIPP WAC will be reflected in future revisions of this WCP.

Regarding any discussions of compliance and verification methods, if a requirement is not met, CCP personnel will segregate the nonconforming item and initiate a Nonconformance Report (NCR) or Correction Action Report (CAR) in accordance with CCP-QP-005, *CCP TRU Nonconforming Item Reporting and Control*, or CCP-QP-006, *CCP Corrective Action Reporting and Control*. Corrective action will be taken in accordance with CCP-QP-004, *CCP Corrective Action Management* to resolve nonconformances. Section 4.3 of this WCP provides additional details about the NCR/CAR process. Only waste from a properly characterized and approved waste stream will be certified as meeting the requirements and associated criteria contained in this WCP. Waste containers for a waste stream that has not been represented by an approved WSPF will not be certified for disposal. The required characterization, certification, and shipment data will be transmitted to WIPP using the WWIS.

### 3.1.1 DOE Operations and Safety Requirements for WIPP

The WIPP Safety Analysis Report (SAR) addresses CH-TRU waste handling and emplacement operations. The waste acceptance for emplacement in the WIPP will conform to the CH-WAC.

### 3.1.2 NRC Transportation Safety Requirements for the TRUPACT-II

Acceptable methods for payload compliance control are defined in the TRAMPAC. For shipments to WIPP, the CCP will prepare a TRAMPAC describing how it will ensure compliance with each payload parameter. The TRAMPAC will contain sufficient detail to allow reviewers to adequately understand and evaluate the compliance methodology for each payload parameter.

The CCP packaging QA program defines the QA activities that apply to the use of NRC-approved transportation packagings in accordance with 10 CFR Part 71, subpart H.

### 3.1.3 NMED Hazardous Waste Facility Permit Requirements

TRU waste is classified as TRU mixed waste if it contains hazardous constituents regulated under Resource Conservation and Recovery Act (RCRA). Only TRU mixed waste and TRU waste that have been characterized in accordance with WIPP-Waste Analysis Plan (WIPP-WAP) and that meet the treatment, storage, and disposal facility waste acceptance criteria as presented in permit conditions II.C.3.a through II.C.3.k of the WIPP Hazardous Waste Facility Permit will be shipped to WIPP for disposal. The CCP QAPjP describes compliance with the WIPP-WAP.

### 3.1.4 EPA Compliance Certification Decision Requirements

Title 40 CFR sec. 194.24(c) states that the DOE shall specify the limiting values for waste components to be emplaced in the repository. Appendix WCL (Waste Component Limits) of the Compliance Certification Application identifies the specific waste components that are associated with the waste proposed for disposal at WIPP.

CCP estimates or determines the weight of cellulose, plastics and rubber and reports this estimate in the WWIS on a container basis. In addition, CCP quantifies and reports the activity values of each of the following radionuclides for purposes of tracking the inventory curie content: $^{241}$Am, $^{238}$Pu, $^{239}$Pu, $^{240}$Pu, $^{242}$Pu, $^{233}$U, $^{234}$U, $^{238}$U, $^{90}$Sr, and $^{137}$Cs. The presence or absence of these radionuclides is determined using AK documentation and radioassay in accordance with Appendix A of the WIPP-WAC. The results of this determination are reported in the WWIS on a container basis.

### 3.1.5 Land Withdrawal Act Requirements

WIPP can only accept radioactive waste generated from nuclear defense activities in the United States. These activities include the manufacture and research of nuclear weapons and the operation of naval reactors. Using AK, CCP determines that each waste stream to be disposed of at WIPP is “defense” TRU waste as defined in Section 3.1.5 of the WIPP-WAC.

## 3.2 Container Properties Criteria and Requirements

### 3.2.1 Payload Container Description

#### 3.2.1.1 Requirements

CH TRU waste shall only be shipped in noncombustible United States Department of Transportation (DOT) Type A 55-gal. drums, pipe overpacks in 55-gal. drums, 85-gal. drum overpacks, standard waste boxes (SWBs), and ten-drum overpacks (TDOPs) in the TRUPACT-II. Containers shall comply with the specifications in the TRUPACT-II SARP, Appendix 1.3.3, Section 2.0 of the TRAMPAC and DOT Specification 7A requirements. Payload containers shall be inspected to ensure they are in good condition prior to shipment. Table 3-1 provides the maximum number of containers in accordance with TRUPACT-II and the authorized packaging configurations.

#### 3.2.1.2 Compliance and Verification

The CCP procures payload containers (e.g., 55-gal. drums, SWBs, and TDOPs) that meet the following requirements:

- SWBs and TDOPs are procured to the same standards and specifications as the containers used in Type A testing.
- New 55-gal. drums are procured as UN1A2 reusable drums, in accordance with applicable requirements of 49 CFR 173, which is allowable per CBFO memo CBFO:NTP:JFS97-1144UFC5822. Drums may also be procured to the same standards and specifications as the drums used in Type A testing.

Recovered drums are inspected to ensure that they are DOT Specification 17C or 17H or meet UN1A2 requirements for reusable drums. Permanent markings embossed on the bottom of the drums are used to verify the drum type if procurement records are not available. Alternatively, if the markings are not visible (e.g., drums that are galvanized through a dipping process, which obscures the embossing), the drums are inspected and inspection results compared to requirements for 17C, 17H, or UN1A2 drums. CCP personnel examine retrievably stored containers for compliance with the applicable requirements and verify that the containers are in good condition in accordance with “CCP Container Management” (CCP-TP-035).

CCP personnel document their procurement acceptance and/or visual inspections. If packages cannot be shown to meet the above requirements by procurement records and/or physical examination, CCP personnel take corrective action (e.g., repackage the waste into a certifiable container) to resolve the nonconformance. CCP personnel will report the number and types of containers to WIPP using WWIS, in accordance with "CCP WWIS Data Entry and TRU Waste Certification" (CCP-TP-030).

**Table 3-1. Maximum Number of Containers per TRUPACT-II and Authorized Packaging Configurations.**

| Maximum Number of Containers | Authorized Packaging |
|---|---|
| 14 | 55-gal. Drum |
| 14 | 55-gal. drums, each containing one pipe component |
| 2 | SWBs |
| 2 | SWBs, each containing one bin |
| 2 | SWBs, each containing up to four 55-gal. drums |
| 1 | TDOP |
| 1 | TDOP, containing up to ten 55-gal. drums |
| 1 | TDOP, containing up to six 85-gal. drums or 85 gal. drum containing a 55 gal. Drum |
| 1 | TDOP, containing one SWB |
| 1 | TDOP, containing one bin within an SWB |
| 1 | TDOP, containing up to four 55-gal. drums within an SWB |

Source: TRAMPAC, Section 2.1.1 and WIPP WAC, Table 3.2.1.

### 3.2.2 Container Weight and Center of Gravity

#### 3.2.2.1 Requirements

Individual payload container weights shall be limited to the weight capacities that meet DOT Type A requirements or the weight limits specified by TRUPACT-II restrictions, whichever is less.

Table 3-2 defines the weight limits that apply to CH TRU waste payload containers, loaded TRUPACT-IIs, and TRUPACT-II shipments. Because weight criteria must be met, different payload configurations are restricted by different requirements. For example, a payload assembly of fourteen 55-gal. drums may not be greater than 7,265 lbs., even though the maximum weight of a single 55-gal. drum may be 1,000 lbs. Although the maximum weight of the payload assembly must not exceed 7,265 lbs., the weight available for the CH TRU waste payload assembly will be less, depending on the

as-built weight of the TRUPACT-II to be used (the average as-built weight of a production TRUPACT-II is 12,705 lbs.). The weight available for the CH TRU waste payload assembly is obtained by subtracting the as-built weight of a TRUPACT-II from the maximum gross weight of 19,250 lbs. The maximum gross weight per TRUPACT-II is specified based on an approximate as-built weight of 13,050 lbs. and an average payload weight of 6,200 lbs. This is usually the limiting weight for two TRUPACT-IIs per shipment. The DOT limit of 80,000-lbs. gross vehicle weight rating must also be met. This is the limiting weight for three TRUPACT-IIs per shipment.

The center of gravity of a loaded TRUPACT-II shall be determined by the weights and locations of the individual CH TRU waste payload containers. The total weight of the top seven-pack of drums or an SWB shall be less than or equal to the total weight of the lower seven-pack of drums or an SWB. The total weight of the top five drums in a TDOP shall be less than or equal to the total weight of the bottom five drums. The scale calibration shall be in accordance with the National Institute of Standards and Technology (NIST) Handbook 44 or equivalent. Weight calculations for the payload assembly must include measurement error.

### 3.2.2.2 Compliance and Verification

CCP loading personnel weigh individual payload containers in accordance with “CCP Container Management” (CCP-TP-035), to ensure that payload containers do not exceed maximum allowable weights determined from Type A testing and evaluation, those shown above, or Table 3-2, whichever is less. CCP loading personnel calibrate and maintain the scale in accordance with NIST Handbook 44, calculate the error, and record the calibration results, in accordance with CCP-QP-016, *CCP Control of Measuring, Test, and Data Collecting Equipment.* If the waste container meets applicable weight limits, loading personnel record the weight of the container for each payload container. If the measured weight of the payload container (including the error) exceeds applicable weight limits, the containers are repackaged and reweighed.

**Table 3-2. Container and Assembly Weight Criteria**

| Component | Maximum Gross Weight (lbs.) |
|---|---|
| ***Individual Payload Container—Required for Certification*** | |
| 55-gal. steel drum (must also meet restrictions in DOT Specification 7A) | ≤1,000 |
| 55-gal. drum overpacked in SWB | ≤1,450 |
| SWB | ≤4,000 |
| TDOP | ≤6,700 |
| ***Pipe Overpack Payload Container—Required for Certification*** | |
| Pipe Overpack 6-in. diameter, in a 55-gal. Drum | ≤328 |
| Pipe Overpack 12-in. diameter, in a 55-gal. Drum | ≤547 |
| ***Payload Container Assembly--After Waste is Certified*** | |
| Payload Container Assembly (14 55-gal. drums or 2 SWBs) | ≤7,265 |
| TRUPACT-II | ≤19,250 |
| Truck (Tractor/Trailer) | ≤80,000 |

Source: TRAMPAC, Section 2.3.1.1 and WIPP WAC, Table 3.2.2.

The TRUPACT-II payload weight limit of 7,265 lbs. includes a payload of 14 drums and the payload pallet, optional slip sheets, reinforcing plates, guide tubes, and banding material; or a payload of two SWBs and optional nylon strap assemblies; or one TDOP. The total payload weight is obtained either from the weights and associated errors of the individual components or by weighing the complete assembly. The load is planned to ensure compliance with the center-of-gravity requirements by placing the heavier seven-pack of drums or the heavier SWB at the bottom of the TRUPACT-II, in accordance with TRAMPAC loading procedures.

### 3.2.3 Removable Surface Contamination (Payload Containers)

#### 3.2.3.1 Requirements

The degree of removable surface contamination for each CH TRU waste payload container, payload assembly and packaging must be measured and documented prior to shipment. Removable surface contamination on CH TRU waste payload containers or container assemblies shall not be greater than 20 disintegrations per minute (dpm) per 100 $cm^2$ for alpha-emitting radionuclides and 200 dpm per 100 $cm^2$ for beta-gamma-emitting radionuclides. Fixing surface contamination to meet the above criterion is not permitted.

#### 3.2.3.2 Compliance and Verification

A host site radiological control technician (RCT) surveys TRU waste payload containers, payload assemblies and packagings, for removable surface contamination before they are loaded for shipment. The RCT assesses removable contamination and documents the results in accordance with host site radiological survey procedures. If the RCT determines that removable contamination exceeds 20 dpm per 100 $cm^2$ for alpha-emitting radionuclides and 200 dpm per 100 $cm^2$ for beta-gamma-emitting radionuclides, CCP personnel determine whether surface contamination can be removed to meet established limits. If compliance with removable surface contamination limits cannot be achieved, CCP personnel segregate and disposition noncompliant container(s) in accordance with nonconformance and corrective action procedures. The survey results are added to the container data package. The WCO confirms removable surface contamination survey results in accordance with host site radiological survey procedures.

### 3.2.4 Container Identification/Labeling

#### 3.2.4.1 Requirements

Each CH TRU waste payload container shall be uniquely identified by means of bar code labels permanently attached in conspicuous locations. The bar code labels shall contain a unique container identification number. The container identification number shall be in medium- to low-density Code 39 bar code symbology (per MIL-STD-1189B) in characters at least 1-in. high, and alphanumeric characters at least 0.5-in. high. The bar code identification labels shall be placed at three locations about 120 degrees apart so that at least one label is clearly visible when drums are assembled into a seven-pack (e.g., a label must be visible after slip sheets and wrapping are applied). The bar code labels are required on the flat sides of SWBs. Each CH TRU waste payload container shall be marked with the shipping category and container identification number after verification of payload parameters. Containers shall be marked in accordance with 10 CFR 835 and/or 40 CFR 262.32, as applicable.

### 3.2.4.2 Compliance and Verification

All containers used by CCP will have three bar code labels approximately 120 degrees apart around the drum that identify the site and contain a unique identification number, in accordance with CCP-TP-035, *CCP Container Management*.

After verifying payload parameters, CCP personnel mark each container with the appropriate site and container identification number and shipping category description, in accordance with CCP-TP-035, *CCP Container Management*. The WCO verifies the container marking.

## 3.2.5 Dunnage

### 3.2.5.1 Requirements

If too few payload containers meeting payload container and transportation requirements are available, dunnage must complete one or more of the configurations specified in Table 3-1. Empty 55-gal. drum(s) or an empty SWB may be used as dunnage, as specified in Section 2.2 of the TRAMPAC. If an empty drum is used as dunnage to complete a seven-pack in a shipment to WIPP, the drum shall be labeled “EMPTY” or “DUNNAGE” and have a container marking in accordance with Section 3.2.4 of this WCP, as appropriate. Dunnage containers shall have open vent ports (e.g., vent ports shall not be plugged or filtered). The empty drum shall be reported by container identification number (CIN) in the data package. Actual data (e.g., zeros, weights) shall be reported in the WWIS data fields for a dunnage drum that is part of a payload assembly. If a seven-pack of empty drums or an SWB is shipped as dunnage to fill a TRUPACT-II, the drums or SWB will be labeled as “EMPTY” or “DUNNAGE” but will not be labeled with container identification numbers or included in WWIS data.

### 3.2.5.2 Compliance and Verification

CCP loading facility personnel load the TRUPACT-II in one of the configurations identified in Table 3-1. If dunnage containers are used to complete a seven-pack assembly, loading personnel will mark each dunnage container with a unique identification number, label the containers "EMPTY" or "DUNNAGE," and document this action. Dunnage drums in a seven-pack assembly are reported by container information number and reported in the WWIS. If a seven-pack of empty drums is shipped as dunnage, each dunnage container is labeled “EMPTY” or “DUNNAGE,” but the containers are not marked with an identification number and not reported in the WWIS. The WCO confirms the use and marking of dunnage containers in accordance with “CCP Container Management” (CCP-TP-035).

### 3.2.6 Filter Vents

#### 3.2.6.1 Requirements

All payload containers (including overpacks, but not dunnage containers) shall be vented with one or more filters to control gas concentration and pressure. Filters shall meet the specifications described in Appendix 1.3.5 and 1.3.7 of the TRUPACT-II SARP and have been approved by CBFO. The filter model number will be reported using WWIS.

#### 3.2.6.2 Compliance and Verification

CCP personnel will procure approved filters for use on TRU waste containers. Filters will be selected from the CBFO acceptance list which is available from the CBFO Web page. Filters will be procured in accordance with the CCP's certified procurement process.

The CCP personnel visually verify that filter vents, if present, have been installed properly. If filter vents are not installed, CCP personnel procure filter vents that meet specifications and install the correct number of filter vents. The WCO confirms payload venting in accordance with "CCP Container Management" (CCP-TP-035). When a payload container does not meet the payload container filter requirements, an NCR is initiated. Nonconforming filters are replaced as necessary.

## 3.3 Radiological Properties

### 3.3.1 Radionuclide Composition

#### 3.3.1.1 Requirements

The radionuclide composition of each waste container must be quantified and reported for purposes of tracking the inventory curie content. The following radionuclides must be quantified and reported: $^{241}$Am, $^{238}$Pu, $^{239}$Pu, $^{240}$Pu, $^{242}$Pu, $^{233}$U, $^{234}$U, $^{238}$U, $^{90}$Sr, and $^{137}$Cs. Shipping papers that accompany the transport of the hazardous materials will include a description of those radionuclides that constitute 95 percent or more of the radiological hazard.

#### 3.3.1.2 Compliance and Verification

CCP uses AK and measurements to determine radionuclide composition. The requirements for NDA are presented in *Radioassay Requirements for Contact-handled Transuranic Waste* (Appendix A) of this WCP. NDA personnel quantify radionuclide values in accordance with those listed in Appendix A. NDA personnel use acceptable knowledge (AK) data and assay measurements and calculations to create an isotopic

profile of each waste container. The radionuclide composition, which comprises 95% or more of the radiological hazard, will be reported for each container using WWIS.

### 3.3.2 Fissile Material Quantity ($^{239}$Pu Fissile Gram Equivalents)

#### 3.3.2.1 Requirements

The fissile or fissionable radionuclide content, expressed in terms of $^{239}$Pu fissile gram equivalent (FGE) plus two times the measurement error, of CH TRU waste payload containers shall be no greater than 200 g per 55-gal. drum or pipe overpack, or 325 g per SWB or TDOP. A TRUPACT-II shall be acceptable for transport only if the $^{239}$Pu FGE plus two times the measurement error is no greater than 325 g for a payload of fourteen 55-gal. drums, two SWBs, or one TDOP, or 2,800 g for a payload of fourteen 55-gal. drums containing pipe components. The $^{239}$Pu FGE shall be calculated using the methods detailed in Section 3.1.2 of the TRAMPAC. Table 3-3 defines the maximum allowable quantity of fissile material, expressed as $^{239}$Pu FGE, for CH TRU waste in the TRUPACT-II.

**Table 3-3. Nuclear Criticality Criteria**

| Payload Container | $^{239}$Pu FGE Limit (grams) |
|---|---|
| 55-gal. drum | ≤200 |
| SWB | ≤325 |
| TDOP | ≤325 |
| Pipe component overpacked in 55-gal. Drum | ≤200 |
| TRUPACT-II (14 55-gal. drums, 2 SWBs, 1 TDOP) | ≤325 |
| TRUPACT-II (14 pipe overpacks) | ≤2800 |

Source: WIPP WAC, Table 3.3.2 and TRAMPAC, Section 3.1.1.

#### 3.3.2.2 Compliance and Verification

CCP personnel obtain the CH TRU waste fissile content in accordance with the NDA process described in Appendix A. Radioassay equipment is qualified under the corresponding Performance Demonstration Program (PDP) requirements. CCP calculates the fissile or fissionable radionuclide content of the CH TRU waste container as $^{239}$Pu FGEs according to approved calculation methods in accordance with "CCP Payload Assembly Determination" (CCP-TP-033).

CCP personnel compile and review AK to make initial determinations about radionuclide content and concentrations. CCP confirms AK by obtaining information on the isotopic composition of the waste through radioassay of the filled payload container.

CCP personnel compute the container $^{239}$Pu FGE and container $^{239}$Pu FGE error manually or using a computational algorithm. Individual radionuclide mass quantities and errors are converted to $^{239}$Pu FGE by multiplying the mass value (g) by $^{239}$Pu FGE conversion factors (FGE/g) listed in the TRAMPAC. The $^{239}$Pu FGE of each payload container shall be calculated from the isotopic composition and quantity of radionuclides. The $^{239}$Pu FGE value plus two times the measurement error shall be less than the applicable limit for each payload container.

The total $^{239}$Pu FGE error is the square root of the sum of the squares of the individual $^{239}$Pu FGE errors. Two times this error shall be added to the $^{239}$Pu FGE of the TRUPACT-II payload and compared to the limit. The $^{239}$Pu FGE of the radionuclides in each waste container will be reported to WIPP using WWIS and the TRUPACT-II payload total FGE will be recorded on the Payload Assembly Transportation Certification Document (PATCD). Payload containers shipped to WIPP will meet both the TRUPACT-II and the WIPP repository requirements for criticality.

### 3.3.3 TRU Alpha Activity Concentration

#### 3.3.3.1 Requirements

TRU waste containers to be disposed of at WIPP shall contain greater than 100 nanocuries (nCi) per gram of waste of alpha-emitting TRU isotopes, with half-lives greater than 20 years. The tare weight of the payload containers (including any rigid liners and any added shielding) shall be subtracted prior to performing the calculation to obtain TRU alpha activity concentration.

#### 3.3.3.2 Compliance and Verification

CCP personnel measure TRU alpha activity concentration in accordance with the NDA process described in Appendix A. CCP personnel calculate the TRU alpha activity concentration of the CH TRU waste container manually or using computational

algorithms. CCP personnel will subtract the tare weight of the containers before calculating the TRU alpha activity concentration. CCP personnel validate and verify calculation programs, before the data are used. Assay data are validated and verified, and submitted in batch data reports to the site project office (SPO). The WCO confirms TRU alpha activity.

### 3.3.4 $^{239}$Pu Equivalent Activity

#### 3.3.4.1 Requirements

In accordance with limits stated in Table 3.3.4 of the WIPP WAC, untreated CH TRU waste shall not exceed 80 Plutonium Equivalent-Curies (PE-Ci) of activity per 55-gal. drum (direct packaged), or 130 PE-Ci of activity per SWB (direct packaged). Untreated CH TRU waste in 55-gal. drums may contain up to 1100 PE-Ci of activity if overpacked in SWBs, 85 gal. drums, TDOPs, or a SWB overpacked in TDOP. A 55-gal. drum containing a pipe component may not exceed 1800 PE-Ci of activity. Solidified/vitrified CH TRU waste shall not exceed 1800 PE-Ci of activity per 55-gal. drum. Appendix B of the WIPP WAC details the methods used to calculate PE-Ci.

#### 3.3.4.2 Compliance and Verification

CCP personnel calculate the activity of the CH TRU waste container as PE-Ci according to the methodology in Appendix B of the WIPP WAC and "CCP Payload Assembly Determination" (CCP-TP-033). CCP personnel identify payload containers exceeding limits stated in Table 3.3.4 of the WIPP WAC, segregate them, and disposition them in accordance with approved nonconformance and corrective action management procedures. The WCO verifies compliance of the PE-Ci limits. CCP personnel will report the PE-Ci activity to WIPP using the WWIS.

### 3.3.5 Radiation Dose Rate

#### 3.3.5.1 Requirements

The external radiation dose rates of individual payload containers and the loaded TRUPACT-II shall be limited to ≤ 200 mrem/hr (beta, gamma, and neutron) at contact and ≤ 10 mrem/hr at 2 meters. Payload containers that meet the radiation dose rate requirements may be shielded to as low as reasonably achievable (ALARA). Internal payload container shielding shall not be used to meet these requirements, except for the pipe component configuration.

#### 3.3.5.2 Compliance and Verification

A host site RCT measures surface dose rates of the individual payload containers in accordance with site radiological survey procedures using the beta-gamma and neutron

dose rates for each container at the surface and at 2 m, and records the results for each payload container. If the combined beta-gamma and neutron dose rate exceeds 200 mrem/hr at the surface or 10 mrem/hr at 2 m for any container, the container is rejected, marked, and segregated. Neutron contributions to the total payload container dose rate shall be reported separately using WWIS.

## 3.4 Physical Properties

### 3.4.1 Liquids

#### 3.4.1.1 Requirements

CH TRU waste shall contain as little residual liquid as is reasonably achievable by pouring, pumping, and aspirating. Internal containers (e.g., bottles, cans) shall contain less than 1 in. (2.5 cm) of liquid in the bottom of the container. Only residual liquids in well-drained internal containers are allowed. The aggregate volume of residual liquid in a payload container shall be less than one volume percent of the payload container.

#### 3.4.1.2 Compliance and Verification

Generators ensure that TRU waste is not in free-liquid form, that minor residual liquids remaining in well-drained internal containers (e.g., bottles, cans); do not exceed 1-in. (2.5 cm) in the bottom of any container; and that the total liquid in the waste package does not exceed 1 volume percent.

Initially, AK is used to determine container contents. AK is confirmed through radiography and/or VE for retrievably stored waste. AK is verified through the VE technique at the time of packaging for newly generated waste. Waste generators ensure that the contents of newly generated waste containers comply with the free liquids restriction. For retrievably stored waste, CCP personnel estimate liquid volume by radiography and/or VE, in accordance “CCP Radiography Inspection Operating Procedure” (CCP-TP-011) and/or “CCP Waste Visual Examination and Repackaging” (CCP-TP-013). During VE, if CCP personnel detect any liquid waste in nontransparent inner containers by shaking the container, they will assume that the container is completely filled and add the entire volume of the container to the total liquid in the payload container. CCP personnel then record the location of any liquid detected in a CH TRU waste container. CCP personnel reject payload containers found to have greater than 1 volume percent liquid or greater than 1-in. of liquid in the bottom of an internal container. If necessary, CCP personnel repackage noncompliant waste containers in accordance with CCP-TP-013, *CCP Waste Visual Examination and Repackaging*.

### 3.4.2 Sealed Containers

#### 3.4.2.1 Requirements

Sealed containers greater than 4 liters (L) are prohibited except for Waste Material Type II.2 packaged in a metal container. Containers greater than 4 L, except for those packaging Waste Material Type II.2, shall not be sealed or shall be fitted with a filter vent. Waste containers with unvented rigid containers greater than 4 L shall be subject to innermost layer of containment sampling or shall be vented prior to initiating drum age and equilibrium criteria.

#### 3.4.2.2 Compliance and Verification

CCP personnel will ensure that payload containers shall be verified to be free of sealed containers greater than 4 L. For newly generated waste, the CCP personnel use the VE technique during packaging to ensure prohibited physical waste forms are not present in waste containers. CCP personnel manage items such as pressurized or sealed containers to eliminate any condition that may result in rejection of the payload container. The CCP personnel verify that the waste placed in the container meets the physical form requirements. For retrievably stored waste, CCP personnel ensure compliance with the physical form requirements through AK verified by radiography and/or VE of the payload container contents. A payload container rejected for noncompliance with the physical form requirements is marked and segregated, or the noncompliant item is removed and the container is repackaged and reprocessed to verify remaining certification requirements. The WCO confirms the sealed container criteria in accordance with “CCP Container Management” (CCP-TP-035).

## 3.5 Chemical Properties

### 3.5.1 Pyrophoric Materials

#### 3.5.1.1 Requirements

Pyrophoric materials, other than radionuclides, shall be rendered safe prior to placement in the CH TRU waste payload container by mixing them with chemically stable materials (e.g., concrete, glass) or shall be processed to remove their hazardous properties. Not more than 1 percent by weight of the CH TRU waste payload in each payload container shall be pyrophoric forms of radionuclides and these shall be generally dispersed in the payload. Nonradionuclide pyrophorics are not allowed, (e.g., elemental potassium).

The 1-percent limitation (by weight) on radionuclides is to allow for any minor residues of uranium or plutonium that may remain in an unoxidized state in the payload. The CH TRU wastes expected to contain metallic radionuclides are to be treated (oxidized) to eliminate as much of the potential pyrophorics as possible prior to placement in payload

containers. A validated process that converts radionuclide pyrophoric compounds to a nonpyrophoric form may be used to meet this requirement.

#### 3.5.1.2 Compliance and Verification

For newly generated waste, CCP personnel use AK and the VE technique during packaging to ensure prohibited items are not present in waste containers in accordance with "CCP Acceptable Knowledge Documentation" (CCP-TP-005) and "CCP Waste Visual Examination and Repackaging" (CCP-TP-013). CCP personnel segregate items to eliminate any condition that may result in rejection of the payload container. CCP personnel verify that the waste placed in the container meets the pyrophoric restriction. For retrievably stored waste, CCP personnel verify compliance with the pyrophorics restriction by obtaining information (e.g., administrative, operating, QA procedures, safety assessments, and radiography) documenting that waste does not contain pyrophorics or other prohibited materials. CCP personnel review and evaluate AK to verify that waste-producing processes included no pyrophorics or other prohibited materials. AK includes sampling and analysis data, documentation of waste stream descriptions, or actions to treat or stabilize the waste to eliminate specific characteristics. CCP personnel verify AK through radiography and VE.

### 3.5.2 Hazardous Waste

#### 3.5.2.1 Requirements

Hazardous wastes not occurring as co-contaminants with TRU wastes (non-mixed hazardous wastes) are not acceptable at WIPP. Each CH-TRU mixed waste container shall be assigned one or more EPA hazardous waste codes as appropriate. Only EPA hazardous waste codes listed as allowable in the Hazardous Waste Facility Permit and specified in Table 3-4 below may be managed at WIPP. Wastes exhibiting the characteristics of ignitability, corrosivity, or reactivity (EPA hazardous waste codes of D001, D002, or D003) are not acceptable at WIPP. In the context of this WCP, hazardous waste codes are synonymous with hazardous waste codes.

Sites are required to make a hazardous waste determination in accordance with applicable requirements of the WIPP WAP. Any waste container that has not undergone either radiographic or visual examination is not acceptable for disposal at WIPP.

#### 3.5.2.2 Compliance and Verification

CCP personnel will ensure that each individual waste payload container is assigned to a waste stream identified by acceptable EPA hazardous waste codes and documented on a DOE- approved Waste Stream Profile Form (WSPF). After DOE approval of the WSPF, CCP personnel will report the hazardous waste codes for each container to WIPP via WWIS. CCP personnel review AK information and implement procedures to

characterize waste streams through headspace gas sampling and analysis on waste containers and homogeneous waste sampling and analysis for nondebris waste streams. For homogeneous waste streams, toxicity characteristic and spent solvent EPA hazardous waste codes are assigned based upon the analytical results and AK. For debris waste, EPA hazardous waste codes are assigned based on AK. Toxicity characteristic (TC) and spent solvent EPA hazardous waste codes are assigned to debris waste streams based on headspace gas sampling and analytical results if AK indicates the waste might contain a constituent in excess of the regulatory level.

**Table 3-4. EPA Hazardous Waste Codes Acceptable at WIPP**

| | | |
|---|---|---|
| F001 | D008 | D030 |
| F002 | D009 | D032 |
| F003 | D010 | D034 |
| F004 | D011 | D035 |
| F005 | D018 | D036 |
| F006 | D019 | D037 |
| F007 | D021 | D038 |
| F009 | D022 | D039 |
| D004 | D026 | D040 |
| D005 | D027 | D043 |
| D006 | D028 | P015 |
| D007 | D029 | |

Source: WIPP WAC, Table 3.5.2.

If data are insufficient to demonstrate that the concentration of the constituent is less than the regulatory level, the EPA hazardous waste number for the identified constituent is applied to the waste stream. CCP will assign hazardous waste codes in accordance with “CCP Acceptable Knowledge Documentation” (CCP-TP-005); “CCP Reconciliation of DQOs and Reporting Characterization Data” (CCP-TP-002); and “ "CCP WWIS Data Entry and TRU Waste Certification) (CCP-TP-030).

### 3.5.3 Chemical Compatibility

#### 3.5.3.1 Requirements

CH TRU mixed waste must not contain chemicals that would cause adverse reactions with other payload containers during handling or disposal. The CH TRU mixed waste must be compatible with backfill, seal, and panel closure materials at the WIPP facility, container and packaging material, and other waste. Waste Streams identified as containing incompatible materials or materials incompatible with waste containers cannot be shipped to WIPP unless they are treated to remove the incompatibility in accordance with "CCP Radiography Inspection Operating Procedure" (CCP-TP-011) and/or "CCP Waste Visual Examination and Repackaging" (CCP-TP-013).

#### 3.5.3.2 Compliance and Verification

CCP personnel ensure compliance with the chemical compatibility requirements based on AK and analytical data. Only wastes that have been shown to meet the approved chemical lists in the TRAMPAC (Appendix 1.3.7, Tables 4-1 through 4-6) are acceptable at WIPP. The WCO confirms compliance with the chemical compatibility criteria. If, necessary, CCP personnel repackage CH TRU waste containers not meeting the chemical compatibility requirement.

### 3.5.4 Explosives, Corrosives, and Compressed Gases

#### 3.5.4.1 Requirements

The CH TRU waste payload shall contain no explosives (49 CFR 173.50), corrosives (49 CFR 73.136), compressed gases (49 CFR 173.115), or pressurized containers and no ignitable, corrosive, or reactive wastes (as defined by 40 CFR 261.21, 261.22, and 261.23, respectively). If corrosives, pressurized containers, or explosive materials are found to be present, they must be physically removed, neutralized, or treated to render them inert such that a violent reaction is not possible.

### 3.5.4.2 Compliance and Verification

CCP personnel ensure that explosives, compressed gases, and corrosive liquids are not present in payload containers. Chemicals (e.g., oxidizers) capable of forming explosive mixtures under some conditions are also prohibited from the waste. Waste-generation processes are assessed for safety hazards such as potential explosion hazards and potential inadvertent production of explosive materials in accordance with "CCP Acceptable Knowledge Documentation" (CCP-TP-005). Corrosives must be either excluded from the payload container or processed to neutralize the corrosive material or otherwise render it noncorrosive. CCP operating procedures describe the specific actions taken to ensure compliance with the corrosive material prohibition, (e.g., "CCP Radiography Inspection Operating Procedure" (CCP-TP-011), "CCP Waste Visual Examination and Repackaging" (CCP-TP-013).

For newly generated waste, CCP personnel use AK and the VE technique during packaging to ensure that there is no indication of the presence of waste materials that may contain explosives, compressed gases, and corrosives in waste containers. CCP personnel process items to eliminate any condition that may result in rejection of the payload container. For retrievably stored waste, CCP personnel verify compliance with the prohibited items requirement by obtaining AK information (e.g., administrative, operating, QA procedures, and safety assessments) documenting that waste does not contain explosives, corrosives, or pressurized containers. CCP personnel review and evaluate AK to verify that waste-producing processes included no prohibited or restricted materials. AK includes sampling and analysis data, documentation of waste stream descriptions, or actions to treat or stabilize the waste to eliminate specific characteristics. CCP personnel verify that prohibited materials are not in the waste container through radiography or VE. Radiography is verified through VE of randomly selected waste in accordance with CCP-TP-013.

## 3.5.5 Headspace Gas VOC Concentrations

### 3.5.5.1 Requirements

Any waste container that has not undergone headspace gas sampling and analysis to determine VOC concentrations is not acceptable at WIPP. The CCP will characterize their waste in accordance with the WIPP WAP.

### 3.5.5.2 Compliance and Verification

CCP personnel ensure that TRU waste containers undergo headspace gas sampling and analysis to determine headspace VOC concentrations in accordance with the QAPjP characterization requirements and "CCP Single-Sample Manifold Headspace Gas Sampling and Operating Procedure" (CCP-TP-007) or "CCP Headspace Gas Sampling and Analysis Operating Procedure" (CCP-TP-008). CCP personnel ensure that the required quality assurance objectives (QAOs) meet the requirements specified for headspace gas VOCs in the QAPjP. The WCO verifies compliance with the headspace gas sampling and analysis requirement and TRUPACT-II loading personnel accept and load only containers that have undergone headspace gas sampling and analysis for VOC concentrations.

## 3.5.6 Polychlorinated Biphenyl Concentration

### 3.5.6.1 Requirements

TRU waste with polychlorinated biphenyl (PCB) concentrations greater than or equal to 50 ppm (as determined by AK or sampling and analysis) is not allowed for disposal in the WIPP.

### 3.5.6.2 Compliance and Verification

CCP personnel use AK "CCP Acceptable Knowledge Documentation" (CCP-TP-005) and/or verification, testing, sampling, and analysis to demonstrate compliance with the PCB requirement. CCP personnel use the VE technique "CCP Waste Visual Examination and Repackaging" (CCP-TP-013) during packaging of newly generated waste to verify that there is no indication that the waste materials may contain PCBs greater than 50 ppm. CCP personnel sample and analyze solidified organic sludge (S3220) waste streams for PCBs. Field screening may be used to confirm AK for soils. Sampling and analysis is conducted in accordance with applicable procedures specified in the QAPjP. For retrievably stored debris waste, CCP personnel compile, record, and evaluate AK to demonstrate compliance with the PCB limitation. The WCO verifies compliance with the PCB requirements.

## 3.6 Gas Generation Properties

### 3.6.1 Payload Shipping Category

#### 3.6.1.1 Requirements

Each payload container shall have an assigned shipping category that is included in an approved content code in the TRUPACT-II Content (TRUCON) document. Two payload shipping category notations are available. Shipping sites may use either the alphanumeric or numeric notation.

All CH TRU waste payload containers shipped in a single TRUPACT-II will be assembled with containers belonging to the same shipping category or payload containers in the same waste type but different bounding G values and resistance, provided the decay heat limit for payload containers within the payload is conservatively assumed to be the same as that of the payload container with the lowest decay heat limit. This is done in accordance with "CCP Payload Assembly Determination" (CCP-TP-033) and is consistent with the *CCP TRUPACT-II Authorized Methods for Payload Control* (TRAMPAC; CCP-PO-003).

#### 3.6.1.2 Compliance and Verification

CCP personnel will categorize, as necessary, waste generated at the host sites into several waste streams. The TRUCON describes how a waste complies with the TRAMPAC. As waste is selected for processing, CCP personnel will assign the shipping category based on AK. For retrievably stored waste, AK is verified by a sampling program. The WCO confirms the shipping category.

### 3.6.2 Decay Heat

#### 3.6.2.1 Requirements

Because of gas generation concerns, there is a wattage limit for individual payload containers and a wattage limit for the TRUPACT-II payload assembly. The decay heat within each payload container plus the measurement error shall be less than or equal to the decay heat limit specified in the TRAMPAC, Table 5-6, for each authorized shipping category. The total decay heat from containers in a TRUPACT-II shall be less than 40 watts. If individual payload containers exceed the limit, these containers must be tested prior to shipment in accordance with *Gas Generation Test Plan to Qualify Test Category Waste for Shipment in the TRUPACT-II* (Attachment 2.0 of the TRAMPAC).

Calculations shall be performed as specified in Section 5.2 of the TRAMPAC to show that individual CH TRU waste payload containers and the total payload assembly to be

transported meet the decay heat limits specified in the TRUCON for the appropriate shipping category.

#### 3.6.2.2 Compliance and Verification

CCP personnel will compute the payload container decay heat and the measurement error manually or using a computational algorithm. CCP personnel will ensure that the results of the calculations are equal to or less than the limits of the assigned shipping category. Individual radionuclide mass quantities and errors are converted to decay heat by multiplying the mass values (g) by decay heat conversion factors (w/g). Table 3-1 in the TRAMPAC lists $^{239}$Pu FGE, decay heat, and specific activity for many radionuclides. The decay heat error for an assembly will be calculated as the square root of the sum of the squares of the individual decay heat error values. The total shipment decay heat (calculated values plus total error) shall be compared to the TRUPACT-II decay heat limit (40 watts).

### 3.6.3 Test Category Waste

#### 3.6.3.1 Requirements

A payload container can be qualified for shipment only if it can be demonstrated (either by analysis or testing) that the molar quantity of hydrogen is maintained at or below the 5 percent limit in confinement layers. A payload container may be placed in the test category when the decay heat loading of the waste in the container exceeds the limit set for the shipping category (specified in the TRAMPAC, Table 5-6) or when a content code does not have a characterized bounding G value.

For a payload container in the test category to be qualified for shipment, its steady-state hydrogen gas generation release rate must be equivalent to the rate for the analytical categories and shall not exceed the limit specified in the TRAMPAC, Tables 5-6 and 5-7.

#### 3.6.3.2 Compliance and Verification

CCP personnel will measure test category containers to determine if the limits on hydrogen gas generation and flammable organics in the headspace are met.

With the exception of Waste Type I (solidified organics), which currently is test category waste by definition, the CCP will repackage test category waste into an acceptable configuration to qualify as analytical category waste. For type IV waste or test category waste that cannot be repackaged, the CCP will segregate this waste until compliance can be demonstrated in accordance with an approved test plan that meets the test category requirements provided in Attachment 2.0 of the TRAMPAC. The TCO will ensure that the testing data is documented in the Payload Assembly Transportation Certification Document (PCTCD) for test category waste.

### 3.6.4 Flammable Volatile Organic Compounds

#### 3.6.4.1 Requirements

The total concentration of potentially flammable volatile organic compounds (VOCs) is limited to 500 ppm in the headspace of a CH TRU waste payload container, as specified in Section 5.4 of the TRAMPAC. Table 3-5 provides the list of flammable VOCs.

#### 3.6.4.2 Compliance and Verification

CCP personnel will verify that wastes are in compliance with the 500-ppm flammable VOC limit through a review of either the documentation of the processes that generated the waste or the sampling and analysis. CCP personnel will obtain headspace gas samples from containers and analyze headspace gas samples to verify that wastes are in compliance with the 500-ppm flammable VOC limit.

The CCP SPM, or designee, reviews the analytical data to ensure that chemical constituents in the waste are allowable in accordance with the TRAMPAC chemical lists and that flammable VOCs in the headspace of the payload containers are less than 500 ppm. The WCO confirms the flammable VOC criteria. CCP personnel identify containers that exceed VOC requirements, segregate them, and ensure that the noncompliant containers are dispositioned, which may include repackaging.

**Table 3-5. Flammable Volatile Organic Compounds**

| Flammable VOCs |
|---|
| Acetone |
| Benzene |
| Butanol |
| Chlorobenzene |
| Cyclohexane |
| 1,1-Dichloroethane |
| 1,2-Dichloroethane |
| 1,1-Dichlorethylene |
| cis-1,2-Dichloroethylene |
| Ethyl benzene |
| Ethyl ether |
| Methanol |
| Methyl ethyl ketone |
| Methyl isobutyl ketone |
| Toluene |
| 1,2,4-Trimethylbenzene |
| 1,3,5-Trimethylbenzene |
| Xylenes |

Source: TRAMPAC, Table 5-8

### 3.6.5 Venting and Aspiration

#### 3.6.5.1 Requirements

TRU waste drums and containers that have been stored in an unvented condition (e.g., no filter installed and rigid liner not punctured) shall be aspirated for a specific length of time in accordance with the TRAMPAC, Section 5.5, to ensure equilibration of any gases that may have accumulated in closed containers prior to shipment. Required aspiration times are listed in the TRAMPAC Tables 5-9 through 5-17.

#### 3.6.5.2 Compliance and Verification

CCP personnel ensure that containers are properly vented or repackage CH TRU waste into vented containers. Unvented containers will be allowed to aspirate for a period of time determined using one of the options and applicable aspiration tables presented in the TRAMPAC. If option 2 or 3 is used to determine aspiration time, CCP personnel follow headspace gas sampling requirements identified in the CCP QAPjP and analyze the headspace gas samples. Analytical personnel determine the concentration of hydrogen in the headspace gas samples. CCP personnel will document the aspiration times. The WCO confirms the aspiration time.

## 3.7 Data Package Contents

### 3.7.1 Characterization and Certification Data

#### 3.7.1.1 Requirements

A data package with certification shall be transmitted prior to shipment. Waste characterization data and WSPFs shall be transmitted to DOE-CBFO, reviewed for completeness, and screened for acceptance and approved by CBFO prior to loading any TRU mixed waste into the TRUPACT-II. The WSPF is provided in the WAP. Data submittal will be complete for each container prior to TRU mixed waste shipment. Only those waste containers that pass Phase II waste-screening determinations will be emplaced at WIPP.

For CH-TRU waste, waste generators must quantify and report each of the following radionuclides for purposes of tracking the inventory curie content: $^{241}$Am, $^{238}$Pu, $^{239}$Pu, $^{240}$Pu, $^{242}$Pu, $^{233}$U, $^{234}$U, $^{238}$U, $^{90}$Sr, and $^{137}$Cs. (Reference 12, Appendix WCL)

### 3.7.1.2 Compliance and Verification

CCP personnel will verify compliance with the data package requirements by reviewing data packages in accordance with “CCP Project Level Data Validation and Verification” (CCP-TP-001). The WCO ensures that the WWIS data are entered into the system and transmitted to the CBFO for approval before waste shipment in accordance with “ "CCP WWIS Data Entry and TRU Waste Certification" (CCP-TP-030). Waste containers will be certified under an approved WSPF prior to shipment.

## 3.7.2 Shipping Data

### 3.7.2.1 Requirements

The TCO shall complete PCTCDs and authorize the TRUPACT-II package for shipment by completing and signing the PATCD. Sites shall also prepare a bill of lading for CH TRU waste shipments in accordance with 49 CFR 172, Subpart C, or Uniform Hazardous Waste Manifests (UHWM) in accordance with 40 CFR 262.23 and a Land Disposal Restriction (LDR) notification in accordance with the State of New Mexico Hazardous Waste Management regulations. The LDR notification for CH TRU waste shipments shall state that the waste is not prohibited from land disposal. For each waste container, the radionuclide composition comprising at least 95 percent of the radiological hazard shall be reported to WIPP. The shipper shall maintain shipping papers for a minimum period of 3 years.

### 3.7.2.2 Compliance and Verification

CCP personnel verify compliance with the data package requirements by reviewing data packages in accordance with “CCP Project Level Data Validation and Verification” (CCP-TP-001). The TCO and WCO ensure that the WWIS data are entered into the system and transmitted to DOE-CBFO for approval before waste shipment in accordance with "CCP WWIS Data Entry and TRU Waste Certification" (CCP-TP-030).

The WCO confirms that the auditable data package is complete. (If the WCO prepares the data package, another qualified individual reviews it.) If deficiencies are identified, the WCO and SPM resolve any deficiencies, and the data package is reviewed again.

The TCO prepares a TRUPACT-II PCTCD for each payload container and a PATCD for each payload assembly in accordance with the TRAMPAC prior to loading the container into a TRUPACT-II. The TCO completes the PCTCD and PATCD to certify and individual payload container and a PATCD to certify the payload assembly for shipping in accordance with "CCP Payload Assembly Determination" (CCP-TP-033), which is based on Section 6.0 of the TRAMPAC. The PCTCDs and the PATCDs are completed prior to loading the TRUPACT-IIs. The shipping site's transportation personnel or CCP personnel prepare a bill of lading or UHWM. For nonmixed waste shipments, a bill of lading is prepared in accordance with the requirements of 49 CFR 172, Subpart C. A UHWM is prepared for mixed waste shipments in accordance 40 CFR 262.23. If the CCP TCO is the shipper of record, shipping data are prepared in accordance with CCP-TP-033.

Transportation packaging personnel perform final inspection and approval of the payload assembly and shipping documents.

## 4.0 QUALITY ASSURANCE PLAN

The CBFO QAPD establishes QA program requirements for the programs, projects, and activities sponsored by CBFO. This QA plan describes and implements the CBFO QAPD requirements for the CCP. It is based on the CBFO QAPD as it applies to the characterization, certification, and transportation of TRU waste as performed by CCP. This QA plan also fulfills the requirements for a transportation QA plan as required by Chapter 10 of the Code of Federal Regulations Part 71(10 CFR 71), Subpart H. The scope of the involved NQA-1 Program is to ensure that all items and activities that are important to the safe containment of TRU Waste in the WIPP are in compliance with Program objectives.

The CCP QA program is developed and maintained through an ongoing process that selectively applies QA criteria as appropriate to the function or work activity being performed.

The organization of this QA Plan is generally based on the CBFO QAPD elements. Table 4-1 provides a cross-reference of identical or related QA requirements from 10 CFR 830.122, ASME NQA-1-1989, ASME NQA-2a-1990 Part 2.7, and DOE Order 414.1A. The applicable criteria are also identified in element descriptions.

## 4.1 ORGANIZATION AND QUALITY ASSURANCE PROGRAM

*(Applicable Criteria: 10 CFR 830.122 Criterion 1*
*40 CFR 194.22(a)(2)(i)*
*DOE O 414.1A Criterion 1)*

This QA program applies to items and activities affecting waste characterization, certification, and transportation by the CCP. The QA program elements are integrated into CCP items and activities through reviews, assessments, inspections, and approval and control of records and documents. The CCP has identified the SPM, SPQAO, TCO, and WCO as being responsible for ensuring QA within the CCP. The responsibilities of each of these positions, as well as other personnel involved with TRU waste characterization and certification are summarized in this WCP (Section 2.1).

Figure I-I (see Section 1.0) illustrates the hierarchy and interrelationships of QA documents governing the QA program. Quality management documents are audited and/or assessed to ensure they meet CCP requirements.

CCP personnel plan certification activities and document the planning process. Planning documentation is subject to review by subject matter experts (SMEs). CCP planning documentation consists of this WCP, the WAP, the WAC, the QAPjP, the TRAMPAC, implementing procedures, QA plans, training plans, and facility and certification process designs.

# Table 4-1. Cross-Reference of Quality Assurance Requirements

| QUALITY ASSURANCE REQUIREMENTS CROSS-REFERENCE MATRIX | | | | |
|---|---|---|---|---|
| | **CBFO QAPD** | **DOE ORDER 414.1A CRITERIA** | **ASME NQA-1 (1989) REQUIREMENTS** | **10 CFR PART 830.122 CRITERIA** |
| MANAGEMENT | 1.1ORGANIZATION | 1 PROGRAM | 1 ORGANIZATION<br>2 QUALITY ASSURANCE PROGRAM | 1 PROGRAM |
| | 1.2 PERSONNEL QUALIFICATION & TRAINING | 2 PERSONNEL TRAINING & QUALIFICATION | 2 QUALITY ASSURANCE PROGRAM | 2 PERSONNEL TRAINING & QUALIFICATION |
| | 1.3 QUALITY IMPROVEMENT | 3 QUALITY IMPROVEMENT | 15 CONTROL OF NONCONFORMING ITEMS<br>16 CORRECTIVE ACTION | 3 QUALITY IMPROVEMENT |
| | 1.4 DOCUMENTS<br>1.5 RECORDS | 4 DOCUMENTS & RECORDS | 6 DOCUMENT CONTROL<br>17 QUALITY ASSURANCE RECORDS | 4 DOCUMENTS & RECORDS |
| PERFORMANCE | 2.1 WORK PROCESSES | 5 WORK PROCESSES | 5 INSTRUCTIONS, PROCEDURES, DRAWINGS<br>8 IDENTIFICATION & CONTROL OF ITEMS<br>9 CONTROL OF PROCESSES<br>13 HANDLING, STORAGE, & SHIPPING | 5 WORK PROCESSES |
| | 2.2 DESIGN CONTROL | 6 DESIGN | 3 DESIGN CONTROL | 6 DESIGN |
| | 2.3 PROCUREMENT | 7 PROCUREMENT | 4 PROCUREMENT DOCUMENT CONTROL<br>7 CONTROL OF PURCHASED ITEMS & SERVICES | 7 PROCUREMENT |
| | 2.4 INSPECTION & TESTING | 8 INSPECTION & ACCEPTANCE TESTING | 10 INSPECTION<br>11 TEST CONTROL<br>12 CONTROL OF MEASURING & TEST EQUIPMENT<br>14 INSPECTION, TEST & OPERATING STATUS | 8 INSPECTION & ACCEPTANCE TESTING |
| ASSESSMENT | 3.1 MANAGEMENT ASSESSMENT | 9 MANAGEMENT ASSESSMENT | 2 QUALITY ASSURANCE PROGRAM | 9 MANAGEMENT ASSESSMENT |
| | 3.2 INDEPENDENT ASSESSMENT | 10 INDEPENDENT ASSESSMENT | 18 AUDITS | 10 INDEPENDENT ASSESSMENT |
| | 4.0 SAMPLE CONTROL REQUIREMENTS | NOT APPLICABLE | NOT APPLICABLE | NOT APPLICABLE |

## Table 4-1. Cross-Reference of Quality Assurance Requirements

| QUALITY ASSURANCE REQUIREMENTS CROSS-REFERENCE MATRIX | | | |
|---|---|---|---|
| **CBFO QAPD** | **DOE ORDER 414.1A CRITERIA** | **ASME NQA-1 (1989) REQUIREMENTS** | **10 CFR PART 830.122 CRITERIA** |
| 5.0 SCIENTIFIC INVESTIGATION REQUIREMENTS | 4 DOCUMENTS & RECORDS<br>5 WORK PROCESSES | 5 INSTRUCTIONS, PROCEDURES, DRAWINGS<br>6 DOCUMENT CONTROL<br>9 CONTROL OF PROCESSES<br>12 CONTROL OF MEASURING & TEST EQUIPMENT<br>17 QUALITY ASSURANCE RECORDS | 4 DOCUMENTS & RECORDS<br>5 WORK PROCESSES |
| 6.0 SOFTWARE REQUIREMENTS | | **ASME NQA-2a-1990, PART 2.7** | |

**NOTE**

ASME NQA-3 is applicable to site characterization. It is not relevant to current CCP activities.

### 4.1.1 Organization

*(Applicable criteria: 10 CFR Part 830.122 Criterion 1*
*DOE O 414.1A Criterion 1*
*ASME NQA-1-1989, Criterion 1*
*CBFO QAPD Section 1.1.1)*

The organization structure, functional responsibilities, levels of authority, and lines of communication for activities affecting quality are documented in this QA Plan, the balance of this document, and CCP implementing procedures.

The SPQAO and CCP quality assurance organization are responsible for assuring the implementation of the QA program and verifying that activities affecting quality have been correctly performed. They have sufficient authority, access to work areas, and organizational freedom to identify quality problems; initiate, recommend, or provide solutions to quality problems; verify implementation of solutions; and assure that further processing, delivery, installation, or use is controlled until proper disposition of nonconformances, deficiencies, or unsatisfactory conditions has occurred. The SPQAO and CCP quality assurance personnel have direct access to responsible management at a level where appropriate action can be effected. They report to a management level such that required authority and organizational freedom are provided, including sufficient independence from cost and schedule considerations.

All personnel involved with TRU waste certification and packaging are responsible for achieving and ensuring the quality of their activities and products. All personnel are responsible for promptly reporting existing, developing, or potential conditions adverse to quality to responsible management for evaluation and action. Management personnel are responsible for achieving and evaluating quality in the work activities under their control.

#### 4.1.1.1 Communication and Interface Responsibilities

*(Applicable Criteria: CBFO QAPD Section 1.1.1.4)*

CCP management communicates to all levels of the organization timely information pertinent to quality performance, including status of the quality program, status and resolution of significant quality problems, lessons learned, quality management practices and improvements, and trend analysis results. CCP communication responsibilities are detailed in CCP-PO-008, *CCP Quality Assurance Administrative Program*.

The responsibility and authority of the CCP and each participating organization are clearly established and documented in an interface document for each site. The external interfaces between CCP participant organizations, the internal interfaces between organizational units, and interface changes are documented. Interface responsibilities are defined and documented and include the requirements for management, performance, and assessment. Interfaces between CCP and the waste generating sites are detailed in a CCP Office level procedure specifically written for each site. Interfaces between CCP and WTS support organizations are defined in CCP-PO-008, *CCP Quality Assurance Administrative Procedure*.

#### 4.1.1.2 Reports to Management

The SPQAO provides the QA interface between facilities and the SPM. The SPQAO oversees the NCR/CAR process for CCP-related deficiencies and coordinates with the SPM to track nonconformances and verify corrective action completion according in accordance with CCP-QP-005, *CCP Nonconforming Item Reporting and Control* and CCP-QP-006, *CCP Corrective Action Reporting and Control*. Facility QA officers report the results of their independent assessments to the SPQAO, and together they track assessment results and corrective actions. The SPQAO reports these independent assessment results to the SPM in accordance with CCP-QP-019, *CCP Quality Assurance Reporting to Management*. Also, the SPQAO prepares and transmits a semiannual QA report to the SPM and the DOE.

#### 4.1.1.3 Delegation of Work

*(Applicable Criteria: CBFO QAPD Section 1.1.1.5)*

Management empowers employees by delegating authority and decision making to the lowest appropriate level in the organization. If work is delegated, the individual making the delegation retains responsibility for the delegated work. The SPQAO is responsible for determining the effectiveness of the QA program, which is accomplished through internal reporting procedures, audits, and assessments.

#### 4.1.1.4 Resolution of Disputes

*(Applicable Criteria: CBFO QAPD Section 1.1.1.6)*

Disputes related to QA program requirements will be resolved by the SPQAO and cognizant CCP personnel.

### 4.1.2 Implementation of the CCP QA Program

*(Applicable criteria: 40 CFR 194.22(a)(1)*
*ASME NQA-1-1989, Criterion 2*
*CBFO QAPD Section1.1.1)*

The CCP QA program is planned, implemented, and maintained in accordance with the requirements found in CBFO QAPD, ASME NQA-1-1989, 40 CFR 194.22, and 10 CFR 830.122. The CCP QA program identifies the activities and items to which it applies, and provides control over activities affecting quality to an extent consistent with their importance. It has been established during the initial stages of the CCP, and has been implemented during the process of program development, start-up, and operation.

The CCP QA program provides for the planning and accomplishment of activities affecting quality under suitable controlled conditions. Controlled conditions include the use of appropriate equipment, suitable environmental conditions for performing waste characterization and transportation activities, and assurance that prerequisites have been satisfied. This program also provides for special controls, processes, test equipment, tools, and skills to attain the required quality and for verification of quality.

#### 4.1.2.1 CCP QAPD Procedures Matrix

*(Applicable Criteria: CBFO QAPD Section 1.1.2.2)*

Procedure CCP-QP-013, *CCP QAPD Matrix* controls the generation and maintenance of the CCP QAPD matrix. This matrix identifies plans and procedures that implement specific requirements of the QAPD.

#### 4.1.2.2 Grading Items and Activities and Applying Management Controls

*(Applicable Criteria: CBFO QAPD Section 1.1.2.4)*

The graded approach to application of QA controls is used by the CCP to determine the importance of the item or activity with respect to the CCP mission, regulatory requirements, hazards, and life-cycle of the item or activity. Management controls are applied commensurate with the determined importance of the item or activity. The CCP uses the graded approach in accordance with CCP-QP-001, *CCP Graded Approach* to comply with CBFO QAPD requirements for grading items and activities and applying management controls. Revisions to CCP-QP-001 are submitted to CBFO for approval prior to implementation.

## 4.2 PERSONNEL QUALIFICATION AND TRAINING

*(Applicable criteria: 10 CFR 830.122 Criterion 2*
*ASME NQA-1-1989, Criterion 2*
*DOE O 414.1A Criterion 2*
*CBFO QAPD Section 1.2)*

The CCP QA program provides for indoctrination and training, as necessary, of personnel performing activities affecting quality to assure that suitable proficiency is achieved and maintained. Personnel performing work in support of CCP receive QA indoctrination and are qualified and trained to ensure that proficiency is achieved and maintained in the performance of their assigned tasks. Records documenting qualifications and completed training programs are maintained and controlled. Training and indoctrination are performed in accordance with CCP-QP-002, *CCP Training and Qualification Plan.*

### 4.2.1 Qualification

The SPM and Training Specialist determine qualification standards for each job category relevant to the CCP and ensure that qualifications of CCP personnel, including minimum education and experience, have been verified. CCP personnel maintain minimum qualifications in accordance with CCP-QP-002, *CCP Training and Qualification Plan.* The SPM determines which positions relevant to the CCP require minimum qualifications. The period of effectiveness for qualification associated with special processes and operations that require special skills and the requalification criteria are specified or referenced in CCP-QP-002. The SPM ensures that auditable records documenting personnel qualifications are maintained as described in CCP-QP-008, *CCP Records Management*. Records of qualified personnel, their areas of qualification, and qualification periods (as appropriate) are retained in the CCP records files.

### 4.2.2 Training

The SPM and Training Coordinator ensure that CCP personnel receive indoctrination and training on the scope, purpose, and objectives of the CCP and the specific QAOs of the tasks being performed. CCP personnel performing activities affecting quality are trained according to the CCP training plan to ensure they achieve and maintain proficiency. Personnel receive initial and continuing training requisite with their activities and level of responsibility, as described in CCP-QP-002, *CCP Training and Qualification Plan*.

Training is designed, developed, conducted, and evaluated in accordance with CCP requirements described in CCP-QP-002. Training programs may include classroom instruction; practical hands-on experience; supervised on-the-job training; self-paced individual study; and written, oral, or practical demonstration of worker competence. The SPM (or designees) analyzes job positions and determines task responsibilities for CCP personnel to ensure education, experience, and training is commensurate with minimum requirements specified. The SPM is responsible for ensuring that auditable records documenting the required training and qualifications are maintained in accordance with CCP-QP-002.

## 4.3 QUALITY IMPROVEMENT

*(Applicable Criteria: 10 CFR 830.122 Criterion 3*
*ASME NQA-1-1989, Criteria 15 & 16*
*DOE O 414.1A Criterion 3*
*CBFO QAPD Section 1.3)*

Conditions adverse to quality are identified promptly and corrected as soon as practical. In the case of a significant condition adverse to quality, the cause of the condition is determined and corrective action taken to preclude recurrence. The identification, cause, and corrective action for significant conditions adverse to quality are documented and reported to appropriate levels of management. Follow-up action is taken to verify implementation of corrective actions.

Items that do not conform to specified requirements are controlled to prevent inadvertent installation or use. Controls are provided for identification, documentation, evaluation, segregation when practical, and disposition of nonconforming items, and for notification to affected organizations.

CCP personnel continually evaluate and improve project activities. The SPQAO ensures that quality improvement in the CCP is achieved by identifying and controlling conditions adverse to quality, analyzing trends, reporting and tracking nonconformances, and implementing corrective actions. These quality improvement activities detect and prevent unacceptable quality problems and thereby increase accuracy and reliability, and reduce variability.

A condition adverse to quality is an all-inclusive term used in reference to failures; malfunctions; deficiencies; and nonconforming items, materials, parts, or components, and processes. CCP personnel ensure that nonconforming items, materials, parts, or components are adequately identified and segregated from acceptable items and materials to preclude their inadvertent use. CCP and facility personnel have the authority to stop certification, packaging, and transportation activities and/or refuse to accept work products or services (e.g., procured items, documentation, packaging, and waste shipments) that do not conform to CCP requirements. CCP personnel report conditions adverse to quality to facility QA officers and/or the SPQAO, who ensure that the condition adverse to quality is investigated and that corrective action is taken as described in this section. CCP employees have the responsibility to stop work that poses a clear and imminent danger to the safety and health of employees, subcontractors, visitors, or the environment.

CCP personnel notify the SPQAO of conditions adverse to quality affecting waste to be shipped to WIPP and forward CARs related to violations of the WIPP Hazardous Waste Facility Permit to the SPQAO for tracking. The CCP notifies DOE-CBFO of conditions adverse to quality. Conditions adverse to quality are documented, evaluated for significance, corrected, tracked, and reported in accordance with CCP-QP-004, *CCP Corrective Action Management*; CCP-QP-005, *CCP TRU Nonconforming Item Reporting and Control;* CCP-QP-006, *CCP Corrective Action Reporting and Control*; and CCP-QP-009, *CCP Work Control Process*. All violations of the WIPP Hazardous Waste Facility Permit will be managed as a significant condition adverse to quality.

Deficiencies are uncontrolled and unapproved deviations from an approved plan, procedure, or expected result. Deficiencies specific to the CCP also include documentation or management practices that do not meet the requirements related to waste certification or payload container preparation, which are identified in the WAP, TRAMPAC, WIPP WAC, QAPD, DOE orders, and applicable federal and state regulations. CCP personnel are responsible for identifying any condition that affects the CCP compliance with these requirements. Assessments may often identify systems, processes, products, or services that do not meet performance criteria established in planning documents. When deficiencies are found, CCP personnel take prompt action to rectify the situation.

Any individual who identifies a condition adverse to quality initiates an NCR or CAR in accordance with CCP-QP-005, *CCP TRU Nonconforming Item Reporting and Control System* or CCP-QP-006, *CCP Corrective Action Reporting and Control*. If the safety or quality of the certification process could be compromised by continued use of a nonconforming item, the item is taken out of service and tagged or otherwise identified to prevent reuse or acceptance until the nonconformance is corrected. The FQAO at the facility where the nonconformance is identified ensures that an NCR is initiated and that corrective action is taken to resolve the nonconformance.

NCRs and CARs are forwarded to the SPQAO. The SPQAO is responsible for validating and tracking CCP-related deficiencies to ensure that corrective action is implemented and that the corrective action resolves the nonconformance. Significant conditions adverse to quality are evaluated by the SPQAO and other affected organizations to determine if a work suspension is necessary. If necessary, work will be suspended until the condition is corrected and verified by the SPQAO. CCP personnel notify DOE-CBFO within five (5) calendar days of identification of any nonadministrative nonconformance related to applicable requirements specified in the WIPP Hazardous Waste Facility Permit WAP, which are first identified at the SPM's signature release level. CCP personnel submit the NCR to DOE-CBFO within thirty (30) calendar days of identification of the deficiency. The SPQAO ensures dissemination of information that may prevent problems or help improve parallel processes in other waste generator or CCP activities and reevaluates system performance after corrective actions have been implemented. The SPM provides the resources necessary to accomplish corrective actions. Any containers with unresolved discrepancies associated with waste characterization cannot be certified for disposal.

The SPQAO, the SPM, and facility QA officers are jointly responsible for identifying the following:

- Trends in nonconformances
- Root causes of nonconformances
- Specific, measurable corrective actions to resolve current problems and prevent recurrence
- Personnel responsible for implementing corrective actions
- Schedules for completing corrective actions.

## 4.4 DOCUMENTS

*(Applicable Criteria: 10 CFR 830.122 Criterion 4*
*ASME NQA-1-1989, Criteria 6*
*DOE O 414.1A Criterion 4*
*CBFO QAPD Section 1.4)*

The preparation, issue, and change of documents that specify quality requirements or prescribe activities affecting quality are controlled to assure that correct documents are being employed. These documents, including changes, are reviewed for adequacy and approved for release by authorized personnel.

CCP personnel prepare and control documents supporting the quality of the CCP in accordance with CCP-QP-007, *CCP Document Control*. Document control coordinators will ensure that:

- Documents are controlled during the review and approval process in accordance with CCP-QP-010, *CCP Document Preparation and Approval*.
- Applicable criteria for the review are identified. Criteria will consider technical adequacy, accuracy, completeness and compliance with requirements.
- Pertinent background information or data is made available to the reviewer.
- Reviews are performed by individuals technically competent in the subject area other than the originator.
- Organizations or technical disciplines affected by the document review the document.
- The SPQAO reviews documents that translate CBFO QAPD or WAP requirements.
- Review comments are resolved and evidence of review comment resolution is maintained
- Documents are approved for release and distributed in accordance with CCP-QP-007, *CCP Document Control*. These documents include:
  - Program planning documents such as this WCP, the QAPjP, the TRAMPAC
  - Plans and procedures implementing TRU waste characterization, certification and packaging
  - CCP procedures implementing QA requirements
- Changes to documents are reviewed by the same organizations that performed the original review and approval.

WTS controlled procedures are used for functions that WTS performs in support of CCP. These functions include procurement support, source inspection support, internal audits, vendor audits, and Qualified Supplier's List (QSL) maintenance. The CCP SPQAO reviews these WTS controlled procedures to ensure that CBFO QAPD requirements that are applicable to CCP activities are addressed. WTS controlled procedures that are used for CCP activities are identified in the CCP-QP-013, *CCP QAPD Matrix*.

## 4.5 RECORDS

*(Applicable Criteria: 10 CFR 830.122 Criterion 4*
*ASME NQA-1-1989, Criterion 17*
*DOE O 414.1A Criterion 4*
*CBFO QAPD Section 1.5)*

Records that furnish documentary evidence of quality are specified, prepared, and maintained. Records are legible, identifiable, and retrievable. Records are protected against damage, deterioration, or loss. Requirements and responsibilities for record transmittal, distribution, retention, maintenance, and disposition are established and documented.

A QA record is an authenticated record that furnishes evidence of the quality of items and/or activities. The minimum lifetime and nonpermanent CCP QA records are identified in the QAPjP. QA records are controlled and maintained to certify compliance with requirements and to reflect completed work. QA records are indexed, classified, controlled, and maintained by records management personnel as described in CCP-QP-008, *CCP Records Management* and the site records system. The records inventory and disposition schedule is also defined in CCP-QP-008.

Waste characterization data and QA/QC records related to TRU waste to be shipped to WIPP are designated as either Lifetime Records, or Non-Permanent Records. Records that are designated as Lifetime Records are maintained by the CCP for the life of the waste characterization program plus six years, then offered to WIPP for inclusion in the WIPP permanent archives. Waste characterization records designated as Non-Permanent Records will be maintained for ten years from the date of record generation and then dispositioned according to their approved Records Inventory and Disposition Schedule (RIDS).

CCP records generated at the sites are maintained in one-hour fire rated safes until completed. Records generated at the CCP Office and completed records are maintained in one-hour fire rated safes or records vaults until dispositioned in accordance with the CCP RIDS. Access to stored quality records is controlled. Specific methods for preparation, revision, protection and control of records during generation and storage are described in CCP-QP-008, *CCP Records Management* and/or the site records system.

## 4.6 WORK PROCESSES

*(Applicable Criteria: 10 CFR 830.122 Criterion 5*
*DOE O 414.1A Criterion 5*
*CBFO QAPD Section 2.1)*

The work processes and items supporting and affecting CCP quality are controlled through plans and procedures identified in this WCP, the QAPjP, the TRAMPAC, and the CCP QAPD Matrix.
Characterization, fabrication, installation, and inspection processes affecting the quality of items or services are controlled by procedures. Special processes that control or verify quality, such as those used in welding, heat treating, and nondestructive examination, are performed by qualified personnel using qualified procedures in accordance with specified requirements.

### 4.6.1 Work

*(Applicable Criteria: CBFO QAPD Section 2.1.1)*

The SPM ensures that CCP activities are controlled and conducted in accordance with CCP-QP-009, *CCP Work Control Process* and facility-specific procedures that describe and control work processes applicable to TRU waste characterization or certification. CCP-QP-009 provides controls for performance of special processes. Special process training and qualification requirements are described in CCP-QP-002, *CCP Training and Qualification Plan*.

Each individual performing work is responsible for ensuring that work processes are controlled and comply with established criteria. The SPM is responsible for ensuring that workers have the correct procedures, materials, and training to perform the required work. Instructions and procedures are maintained current with a documented and controlled method of revision. Instructions, procedures, and drawings are readily available to CCP personnel at locations requiring their use through either hard copy or electronic media.

### 4.6.2 Implementing Procedures

*(Applicable criteria: ASME NQA-1-1989, Criterion 5*
*CBFO QAPD Section 2.1.2)*

Activities affecting quality are prescribed by and performed in accordance with documented instructions, procedures, or drawings of a type appropriate to the circumstances. These documents include or reference appropriate quantitative or qualitative acceptance criteria for determining that the prescribed activities have been satisfactorily accomplished.

CCP procedures and plans are developed, reviewed, approved, revised, and distributed in accordance with CCP-QP-007, *CCP Document Control* and CCP-QP-010, *CCP Document Preparation and Approval*. CCP technical and QA personnel comply with the applicable technical standards and administrative controls described in procedures, which are reviewed and approved by the SPM (or designee) and the SPQAO (or designee) in accordance with CCP-QP-007, *CCP Document Control* and CCP-QP-010, *CCP Document Preparation and Approval*. The SPM ensures personnel perform work following established procedures. For work processes such as procurement, source inspection, and auditing, applicable WTS procedures are also used. CCP procedures addressing these subjects provide the required interfaces to these WTS procedures. WTS procedures applicable to CCP work processes are identified in CCP-QP-013, *CCP QAPD Matrix*.

The procedures identified in this WCP, the QAPjP, the TRAMPAC, and the CCP QAPD Matrix provide the following information:

- organizational and individual responsibilities
- training and qualification requirements
- technical, regulatory, and QA requirements
- step-by-step instructions for the process
- equipment specifications
- identification and control of items used or installed
- prevention of damage or loss and minimization of deterioration of items and materials during handling, storage, and shipment of items
- methods and criteria for ensuring and verifying the acceptability of equipment and materials used in the process (e.g., calibration)
- prerequisites, precautions, process parameters, and other limiting conditions
- products of the process
- quantitative and/or qualitative criteria for determining that prescribed process activities have been performed satisfactorily
- records generated by the process
- package and design control of equipment and materials

### 4.6.3 Item Identification and Control

*(Applicable Criteria: ASME NQA-1-1989, Criterion 8)*

Controls have been established to assure that only correct and accepted items are used or installed. Identification is maintained on items or in documents traceable to the items, or in a manner which assures that identification is established and maintained.

Items are identified and traced from time of receipt through end use. Physical markings, labels, tags or segregation are used to provide item identification and status. Specific details are provided in CCP-QP-017, *CCP Identification and Control of Items*.

### 4.6.4 Special Processes

*(Applicable Criteria: ASME NQA-1-1989, Criterion 9*
*CBFO QAPD Section 2.1.4)*

Special processes that control or verify quality, such as those used in nondestructive examination, are performed by qualified personnel using qualified procedures in accordance with specified requirements.

Processes are considered to be special processes if:

- results are highly dependent on the control of the process
- results are highly dependent on the skill of the operator, or
- quality of the results cannot be readily determined by inspection or test of the product.

Implementing procedures have been developed to control special processes such as Real Time Radiography that are currently performed by CCP. Training and qualification requirements for operators are identified in CCP-QP-002, *CCP Training and Qualification Plan*. CCP-QP-009, *CCP Work Control* describes the controls placed on special processes.

### 4.6.5 Handling, Storage, and Shipping

*(Applicable Criteria: ASME NQA-1-1989, Criterion 13*
*CBFO QAPD Section 2.1.5)*

Handling, storage, cleaning, packaging, shipping, and preservation of items are controlled to prevent damage or loss and to minimize deterioration. Controls are provided through work and inspection procedures, shipping instructions, or other appropriate document.

Measures are established in CCP-QP-015, *CCP Procurement* and CCP-QP-023, *CCP Handling, Storage and Shipping* to ensure that systems, components and items used for repair work for maintenance purposes or packaging purposes are adequately identified to preclude the use of incorrect or defective items. Also, where replacement of limited shelf life items is specified, measures are established to preclude use of items whose shelf life or time in operation has expired. Handling, storage, cleaning, shipping, and other means of preserving, transporting, and packaging of items are controlled in accordance with CCP-QP-023, *CCP Handling, Storage, and Shipping*.

## 4.7 PROCUREMENT

*(Applicable Criteria: 10 CFR 830.122 Criterion 7*
*ASME NQA-1-1989 Criteria 4 & 7*
*DOE O 414.1A Criterion 7*
*CBFO QAPD Section 2.3)*

Applicable design bases and other requirements necessary to assure adequate quality are included or referenced in documents for procurement of items and services. Procurement documents require suppliers to have a quality assurance program consistent with the graded application of quality requirements. Procurements are controlled to assure conformance with specified requirements. Procurement controls provide for source evaluation and selection, evaluation of objective evidence of quality furnished by the supplier, source inspection, audit, and examination of items or services upon delivery or completion.

CCP implements procedures to ensure that procurement of items and services important to safety and quality meet requirements and perform as intended. Procurement controls are applicable to equipment and services, including commercial grade items, that directly affect testing, sampling, and analytical data quality. WTS provides support to the CCP for procurement process elements such as procurement planning, supplier selection and evaluation, bid evaluation, supplier performance evaluation, requisition review and processing, and procurement records. CCP personnel adhere to procurement and record keeping practices established in written procedures. The procurement criteria are implemented according to CCP-QP-015, *CCP Procurement*, WTS procedure WP 15-PC3609 *Preparation of Purchase Requisitions and Purchase Requisition Change Notices*, and the procedures specified in the following subsections. The CCP QAPD Matrix references the implementing procedures that contain the specific procedural requirements and responsibility for and methods of implementation.

### 4.7.1 Procurement Documents

*(Applicable Criteria: CBFO QAPD Section 2.3.2.4)*

The SPM ensures that CCP personnel control procurement documents in accordance with CCP-QP-015, *CCP Procurement*. Procurements are planned and controlled to assure that suppliers have quality assurance programs consistent with the intended use of the item being procured. Procurement documents supporting waste management and packaging and transportation activities must include required specifications and acceptance criteria. Procurement documents are reviewed by appropriate organizations and engineering disciplines to ensure that they contain adequate scope of work, technical requirements, supplier QA program requirements, and provisions for acceptance. Qualified CCP personnel, including the SPQAO, verify suppliers' conformance to procurement document requirements.

### 4.7.2 Acceptance and Control of Purchased Items or Services

*(Applicable Criteria: CBFO QAPD Section 2.3.2.7)*

The SPM ensures that CCP personnel control items and services purchased (including supplier evaluations and inspections) in accordance with CCP-QP-015, *CCP Procurement*, WTS Procedure WP 15-PC3609 *Preparation of Purchase Requisitions and Purchase Requisition Change Notices,* and CCP-QP-001, *CCP Graded Approach*. Documentary evidence of conformance to the procurement specifications is provided before installation or use of systems, components, items, and services, and is retained in accordance with CCP-QP-015, *CCP Procurement*. Acceptance of quality related systems, components, items and services by the CCP will be through source verification, receipt inspection, post-installation testing, or supplier certificate of conformance as appropriate to the quality level. Supplier nonconformances will be documented, tracked, and dispositioned in accordance with CCP-QP-015, *CCP Procurement*.

### 4.7.3 Control of Supplier Nonconformances

*(Applicable Criteria: CBFO QAPD Section 2.3.2.8)*

Subcontractors perform work that directly affects the quality of characterization and certification data. CCP-QP-015, *CCP Procurement* describes how CCP personnel control subcontractor services. Subcontractors may support CCP activities under a “staff augmentation” role or for procurement of products and services. CCP staff augmentation subcontractors operate under the umbrella of the CCP QA program and are subject to applicable requirements for CCP-related functions that they perform. Subcontractors who support the CCP will be informed of the need to perform operations in compliance with CCP requirements.

If subcontractors are authorized to perform procurements of quality-affecting items and services, they are required to establish procurement controls and a QA program to ensure that purchased materials, equipment, and services conform to the CCP procurement and QA program documents. The controls must include provisions, as appropriate, for source evaluation and selection, objective evidence of quality furnished by the contractor or subcontractor, inspection at the contractor or subcontractor source, and examination of products on delivery. Subcontractors are subject to periodic assessments and audits at intervals consistent with the importance, complexity, and quantity of the product or services provided to ensure compliance with procurement requirements. Subcontractor personnel must meet applicable CCP training and qualification requirements. Subcontractors shall submit copies of CCP-related, quality affecting documents to the SPM.

Items and services procured for the CCP are subject to control of nonconformances. Quality Levels are determined for items and services procured for use by CCP, and quality-affecting items are evaluated for adequacy prior to use through receipt inspection, source inspection, functional testing, or other appropriate means. Items that are found deficient are documented, controlled to prevent use, evaluated, and corrective actions performed.

A combination of CCP and WTS procedures are used to exercise controls over supplier nonconformances. They include CCP-QP-015, *CCP Procurement,* CCP-QP-004, *CCP Corrective Action Management,* CCP-QP-005, *CCP TRU Nonconforming Item Reporting and Control,* CCP-QP-006, *CCP Corrective Action Reporting and Control,* WP 15-PC3609, *Preparation of Purchase Requisitions and Purchase Requisition Change Notices*.

### 4.7.4 Commercial Grade Items

*(Applicable Criteria: CBFO QAPD Section 2.3.2.9)*

Commercial grade items may be used when specified by design. Commercial grade items are identified in procurement documents using manufacturer or distributor catalog numbers or descriptions. Data collection and test instruments procured as commercial grade items that are intended for use in quality related applications are calibrated by qualified suppliers of calibration services prior to use. Commercial grade items are procured in accordance with CCP-QP-015, *CCP Procurement,* CCP-QP-026, *CCP Inspection Control,* WP 15-PC3609 *Preparation of Purchase Requisitions and Purchase Requisition Change Notices,* WP 13-QA3012, *Supplier Evaluation and Qualification,* and WTS Procurement Services Commercial Instruction C1015 *Supplier Selection.*

## 4.8 INSPECTION AND TESTING

*(Applicable Criteria: 10 CFR 830.122 Criterion 8*
*ASME NQA-1-1989, Criteria 10 & 14*
*DOE O 414.1A Criterion 8*
*CBFO QAPD Section 2.4)*

Inspections required to verify conformance of an item or activity to specified requirements are planned and executed. Characteristics to be inspected and inspection methods to be employed are specified. Inspection results are documented. Inspection for acceptance is performed by persons other than those who performed or directly supervised the work being inspected.

The status of inspection and test activities is identified either on the items or in documents traceable to the items where it is necessary to assure that required inspections and tests are performed and to assure that items which have not passed the required inspections and tests are not inadvertently installed, used, or operated. Status is

maintained through indicators appropriate to the activity or item, such as physical location and tags, markings, travelers, stamps, inspection records, or other suitable means. The authority for application and removal of tags, markings, labels, and stamps is specified.

Equipment is tested, inspected, and maintained in accordance CCP-QP-016, *CCP Control of Measuring, Testing, and Data Collection Equipment*; CCP-QP-026, *CCP Inspection Control*; and CCP-QP-027, *CCP Test Control*. CCP personnel identify and control items (e.g., items with limited shelf or operating lives, materials, equipment, and samples) and ensure that only correct and accepted items are used according to CCP-QP-026, *CCP Inspection Control*. These procedures and documents address planning, parameters for evaluation, techniques to be used, qualifications of inspection and test personnel, hold points, documentation, acceptance criteria, and organizational responsibilities.

CCP personnel routinely test and inspect items and processes and control, calibrate, and maintain equipment to ensure proper operation and data quality. Procedures identified above implement an inspection program that establishes criteria for inspection of activities affecting quality by, or for, the organization performing the activity, and to verify conformance with the requirements for accomplishing the activity. The verification is performed in accordance with written procedures, instructions, or drawings. Personnel performing the inspections are independent from the individuals performing the activity being inspected. Equipment modifications, repairs, and replacement are inspected in accordance with the original design and inspection requirements unless an approved alternative exists. The inspection program also provides for identification and documentation of deficiencies discovered during the inspection. Measures are established to indicate, by the use of markings, tags, stamps, labels, routing cards, or other suitable means, the status of inspections and tests performed. These measures provide for the identification of items that have satisfactorily passed required inspections and tests, where necessary, to preclude inadvertent bypassing of the inspections and tests.

Quality related procured items are inspected by qualified personnel at receipt or at the source prior to shipment. These inspections may include dimensional verification, functional testing, verification of documentation or other appropriate methods.

### 4.8.1 Qualification of Inspection and Test Personnel

*(Applicable Criteria: CBFO QAPD Section 2.4.2.1)*

Inspection and test personnel are trained and qualified in accordance with CCP-QP-002, *CCP Training and Qualification Plan*. Candidates for inspection and test positions are evaluated for previous education, experience, training, and testing as appropriate. Minimum qualifications are established, and personnel selected for these activities are documented to have experience or training commensurate with the scope, complexity, or

special nature of the inspections or tests performed. Inspection and test personnel are indoctrinated in the technical and QA objectives, requirements, and controls, and formal or on-the-job training is performed as appropriate. Qualifications are documented, and records maintained in the CCP records system.

Job performance of inspection and test personnel is evaluated at periodic intervals, and is performed through review of evidence of continued satisfactory performance or redetermination of capability. If personnel are found to not perform adequately, they are removed from that function until the required capability is demonstrated. Personnel that have not performed inspection or testing activities in their qualified area for more than a year are re-evaluated for the required capability.

### 4.8.2 Qualification of Nondestructive Examination Personnel

*(Applicable Criteria: CBFO QAPD Section 2.4.2.2)*

Personnel performing nondestructive examinations (NDE) are trained and qualified in accordance with CCP-QP-002, *CCP Training and Qualification Plan.* This procedure implements the requirements of the American Society of Nondestructive Testing (ASNT) Recommended Practice No. SNT-TC-1A, June 1980 edition. Training and qualification of NDE personnel are documented and records maintained in the CCP records system.

### 4.8.3 Inspection Requirements

*(Applicable Criteria: CBFO QAPD Section 2.4.2.3)*

Inspections are planned, performed and documented in accordance with CCP-QP-026, *CCP Inspection Control*. Inspection planning includes identification of work operations to be inspected, inspection hold points, identification of characteristics to be inspected, inspection methods, acceptance criteria, sampling requirements, method of documentation of inspection results, M&TE to be used, and identification of statistical methods for sampling.

The types of inspections that may be performed include:

- in-process inspections and monitoring
- final inspections
- inservice inspections

Each of these types of inspections may include review of documentation, examination or verification of physical characteristics, performance of tests, or other means of verifying quality and conformance to the applicable requirements.

Inspections are documented and records maintained as part of the CCP records system.

### 4.8.4 Test Requirements

*(Applicable Criteria: ASME NQA-1-1989, Criterion 11*
*CBFO QAPD Section 2.4.2.4)*

Tests required to verify conformance of an item or computer program to specified requirements and to demonstrate satisfactory performance for service shall be planned and executed. Characteristics to be tested and test methods to be employed are specified. Test results are documented and their conformance with acceptance criteria are evaluated.

Tests required to collect data are planned, executed, documented and evaluated. Test planning includes identification of test procedures, test requirements and acceptance limits, including required levels of precision and accuracy, identification of M&TE, test prerequisites, hold points, and test and data documentation requirements. Test results are documented and their conformance with acceptance criteria are evaluated by qualified personnel.

Testing is performed in accordance with CCP-QP-027, *CCP Test Control*.

### 4.8.5 Monitoring, Measuring, Testing, and Data Collection Equipment

*(Applicable Criteria: 10 CFR 830.122, Criterion 5*
*ASME NQA-1-1989, Criterion 12*
*CBFO QAPD Section 2.4.3)*

Tools, gages, instruments, and other measuring and test equipment used for activities affecting quality are controlled and at specified periods calibrated and adjusted to maintain accuracy within necessary limits. This equipment is controlled in accordance with CCP-QP-016, *CCP Control of Measuring, Testing, and Data Collection Equipment*.

#### 4.8.5.1 Use and Control of M&TE

Measuring and test equipment with the necessary range and accuracy is provided to qualified personnel for the inspection, test, and acceptance of material, parts, components, and systems. The specific controls imposed on measuring and test equipment are described in procedure CCP-QP-016 *CCP Control of Measuring, Testing, and Data Collection Equipment* and CCP-QP-026 *CCP Inspection Control*. Control processes for M&TE include recall for calibration and procurement of calibration services from laboratories meeting the requirements of ANSI/NCSL Z540-1, *Calibration Laboratories and Measuring and Testing Equipment – General Requirements.* M&TE are labeled, and any that are found to be out of calibration are reviewed to determine the impact. Records are maintained in the CCP records system.

### 4.8.5.2 Calibration

Equipment accuracy is ensured by periodic calibration that is traceable to national standards or a documented equivalent basis for calibration. The specific controls imposed on measuring and test equipment are described in procedure CCP-QP-016 *CCP Control of Measuring, Testing, and Data Collection Equipment* and CCP-QP-026 *CCP Inspection Control*.

## 4.9 MANAGEMENT ASSESSMENTS

*(Applicable Criteria: 10 CFR 820.122 Criterion 9*
*ASME NQA-1-1989 Criterion 2*
*DOE O 414.1A Criterion 9*
*CBFO QAPD Section 3.1)*

CCP management regularly assess the adequacy of that part of the CCP QA program for which they are responsible to assure its effective implementation, and ensure compliance with applicable requirements. Management assessments are conducted according to CCP-QP-018, *CCP Management Assessment* and independent assessments according to CCP-QP-020, *CCP Independent Assessment*. CBFO and external regulatory agencies also conduct assessments of the CCP. The SPQAO tracks deficiencies identified during assessments; identifies corrective actions to resolve deficiencies according to CCP-QP-004, *CCP Corrective Action Management*, CCP-QP-005, *CCP TRU Nonconforming Item Reporting and Control*, and CCP-QP-006, *CCP Corrective Action Reporting and Control*; and ensures the resolutions are reported to the SPM and CBFO. Documentation of deficiencies identified in CCP activities conducted at waste generating sites are also reported to the appropriate quality assurance organizations at those sites.

CCP management periodically assesses the performance of its organization to determine the effectiveness of QA Program provisions that enable the organization to comply with requirements of the WAP, QAPD, WIPP WAC, and applicable procedures and documents. Managers evaluate QA Program effectiveness by focusing on the identification and resolution of both systemic and management issues and problems, and identifying strengths and weaknesses to facilitate actions to improve quality efficiency and cost-effectiveness. Management assessments may include an introspective evaluation to determine whether the entire integrated management system effectively focuses on meeting strategic goals. Management assessments are conducted as described in CCP-QP-018, *CCP Management Assessment*. CCP management is responsible for the conduct of these assessments and reports at least annually on relevant findings.

## 4.10 INDEPENDENT ASSESSMENTS

*(Applicable Criteria: 10 CFR 830.122, Criterion 10*
*ASME NQA-1-1989, Criterion 18*
*DOE O 414.1A, Criterion 10*
*CBFO QAPD Section 3.2)*

Planned and scheduled audits are performed to verify compliance with all aspects of the quality assurance program and to determine its effectiveness. These audits and surveillances are performed in accordance with written procedures or checklists by personnel who do not have direct responsibility for performing the activities being audited. Audit and surveillance results are documented and reported to and reviewed by responsible management. Follow-up actions are taken where indicated.

Documented independent assessments (audits and surveillances) are used to measure item service and quality, process adequacy and effectiveness, and to promote improvement. Independent assessments are conducted in accordance with CCP-QP-020, *CCP Independent Assessments.* CCP personnel and facilities are subject to periodic independent assessments scheduled by the WIPP Quality Assurance Manager and conducted by personnel independent of CCP. The SPQAO ensures that characterization facilities and analytical laboratories are assessed and determines whether the independent assessment is an audit or process surveillance (see below). In addition, facility QA officers may perform independent assessments (audits or surveillances) of CCP activities at their facilities. Audit teams include one or more qualified auditors, one of whom must be a certified lead auditor. Audit and surveillance personnel qualifications are addressed in CCP-QP-002, *CCP Training and Qualification Plan* and CCP-QP-024, *CCP Certification of CCP Audit Personnel,* and are in accordance with the QAPD.

The independent assessment team consists of a team leader and team members and technical specialists selected by the team leader in conjunction with the SPQAO or WIPP Quality Assurance Manager as applicable. The team leader provides indoctrination and supervision of the team, organizes and directs the assessment, establishes the scope of the assessment, prepares a plan for conducting the assessment, and prepares and issues an assessment report to the management of the assessed organization and any affected organizations. The assessment team members and technical specialists prepare the assessment checklist, conduct the assessment, brief the management of the assessed organization on a daily basis, and prepare a draft report for presentation at the exit conference for the assessment. Assessments are performed in accordance with CCP-QP-020, *CCP Independent Assessments* and CCP-QP-021, *CCP Surveillance Program.*

### 4.10.1 Surveillances

Surveillances are conducted primarily to monitor work in progress and to follow up on corrective actions. Surveillance results are reported and monitored similar to other assessment activities. Surveillances are performed in accordance with CCP-QP-021, *CCP Surveillance Program*.

### 4.10.2 Audits

Internal and external audits are planned and scheduled throughout the life of the CCP and are conducted by qualified personnel. Audit team members are selected on the basis of technical qualifications and knowledge of the item or process being audited, and are independent from the items or processes being audited. Audit team members have sufficient authority and organizational freedom to carry out their assigned responsibilities. For internal audits, personnel having direct responsibility for performing the activities being audited are not involved in the selection of the audit team.

Audit preparation includes review of pertinent background information, procedures and technical documents, past assessment results, and evaluation of recurring problems. Audit scopes include technical evaluations of applicable procedures, instructions, activities, and items as well as applicable elements of the CCP quality assurance program. Results of audits are documented and reported to CCP management.

The SPQAO ensures that conditions adverse to quality identified during audits are resolved, and that appropriate corrective actions are implemented in a timely manner. The SPQAO develops a schedule that details follow-up activities and final resolution of corrective actions. The SPQAO tracks corrective actions to completion and monitors the status of corrective actions to ensure timely closure of deficient conditions.

The CCP is subject to CBFO certification audits. A CBFO audit of the CCP is conducted before any waste characterized by the CCP is shipped to the WIPP and annually thereafter. In addition, the CBFO may conduct audits on a random basis. These audits are scheduled through the CBFO QA manager who coordinates the plans and schedule through the SPM.

Audits are prepared, conducted, and reported in accordance with CCP-QP-020, *CCP Independent Assessments.*

## 4.11 SAMPLE CONTROL REQUIREMENTS

CCP does not process homogeneous waste samples or gas canisters. If in the future, sampling activities require collection of discrete samples, the appropriate sample control requirements will be implemented.

## 4.12 SCIENTIFIC INVESTIGATION REQUIREMENTS

*(Applicable Criteria: CBFO QAPD Section 5.2.C, Section 5.3)*

Logbooks and notebooks used in CCP activities are controlled, completed, reviewed and maintained as QA records in accordance with CCP-QP-011 *CCP Notebooks and Logbooks*.

Data are controlled to prevent loss and ensure integrity, security and freedom from error. Erroneous, rejected or superseded data are controlled to prevent use. Data uncertainty levels are determined prior to use. Data reduction methods are prescribed in technical procedures to allow validation of the reduction process. Data verification and validation is performed to assure accuracy, completeness and traceability in accordance with QA and technical procedures. These procedures include CCP-TP-001, *CCP Project Level Data Validation and Verification*, CCP-TP-002, *CCP Reconciliation of DQOs and Reporting Characterization Data*, CCP-TP-003, *CCP Sampling Design and Data Analysis for RCRA Characterization*. Additional procedures are identified in the CCP QAPD Matrix.

## 4.13 SOFTWARE

*(Applicable Criteria: ASME NQA-2a-1990 Part 2.7)*
*CBFO QAPD Section 6)*

Computer software and hardware/software configurations used in CCP activities are developed, documented, verified, validated, and tested prior to use in compliance with requirements contained in the QAPD, QAPjP, and NQA-1, Subpart 2.7, *Quality Assurance Requirements of Computer Software for Nuclear Facility Applications* (ASME 1989). CCP-QP-022, *CCP TRU Software Quality Assurance* describes the processes for computer software development, validation, and verification.

Software used by CCP are identified and controlled through inventory and categorization, and configuration management is maintained. CCP-QP-022 *CCP TRU Software Quality Assurance* provides the controls for configuration management; software procurement and development; software life-cycle management including installation, testing, verification and validation, operation, and retirement; access controls; and required documentation. Software problems are identified and reported, and changes to software are controlled.

## 4.14 PERFORMANCE DEMONSTRATION PROGRAM

The CCP participates in the Performance Demonstration Program (PDP) as summarized in the QAPjP. PDP samples are processed according to the CCP procedures applicable to the specific testing or analytical characterization activity being assessed. Laboratories will have approved and documented QA/QC programs.

## 5.0 REFERENCES

10 CFR Part 71, "Packaging and Transportation of Radioactive Material," *Code of Federal Regulations*, Washington, D.C., Office of the Federal Register National Archives and Records Administration.

10 CFR Part 830, "Nuclear Safety Management," *Code of Federal Regulations*, Washington, D.C., Office of the Federal Register National Archives and Records Administration.

10 CFR Part 835, "Occupational Radiation Protection," *Code of Federal Regulations*, Washington, D.C., Office of the Federal Register National Archives and Records Administration.

40 CFR Part 191, "Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," *Code of Federal Regulations*, Washington, D.C., Office of the Federal Register National Archives and Records Administration.

40 CFR Part 194, "Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 "Disposal Regulations," *Code of Federal Regulations*, Washington, D.C., Office of the Federal Register National Archives and Records Administration.

40 CFR Part 261, "Identification and Listing of Hazardous Waste," *Code of Federal Regulations*, Washington, D.C., Office of the Federal Register National Archives and Records Administration.

40 CFR Part 262, "Standards Applicable to Generators of Hazardous Wastes," *Code of Federal Regulations*, Washington, D.C., Office of the Federal Register National Archives and Records Administration.

40 CFR Part 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," *Code of Federal Regulations*, Washington, D.C., Office of the Federal Register National Archives and Records Administration.

40 CFR Part 268, "Land Disposal Restrictions," *Code of Federal Regulations*, Washington, D.C., Office of the Federal Register National Archives and Records Administration.

40 CFR Part 270, "EPA Administered Permit Programs: The Hazardous Waste Permit Program," *Code of Federal Regulations*, Washington, D.C., Office of the Federal Register National Archives and Records Administration.

49 CFR Part 172, "Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements," *Code of Federal Regulations*, Washington, D.C., Office of the Federal Register National Archives and Records Administration.

49 CFR Part 173, "Shippers-General Requirements for Shipments and Packagings," *Code of Federal Regulations*, Washington, D.C., Office of the Federal Register National Archives and Records Administration.

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DOE, 1997, *Carlsbad Area Office Interim Guidance on Ensuring that Waste Qualifies for Disposal at the Waste Isolation Pilot Plant*, Current Revision, Carlsbad Area Office, Carlsbad, New Mexico, U.S. Department of Energy.

DOE, 1997b, *TRUPACT-II Operating and Maintenance Instructions*, DOE/WIPP 93-1001, Current Revision, Waste Isolation Pilot Plant, Carlsbad, New Mexico, U.S. Department of Energy.

DOE, 1999a, *U.S. Department of Energy-Carlsbad Area Office Quality Assurance Program Document*, CAO-94-1012, Current Revision, Carlsbad Area Office, Carlsbad, New Mexico, U.S. Department of Energy.

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# Appendix A

## Radioassay Requirements for Contact-handled Transuranic Waste

### A.1 Introduction

Radioassay techniques are used to determine the radionuclide content of waste. Radioassay methods include both nondestructive and destructive techniques. The term "radioassay" includes all types of assay techniques. Nondestructive assay (NDA) refers only to nonintrusive assay techniques, whereas radiochemistry (RC) is used to refer to destructive assay techniques. This appendix is intended to apply to NDA activities conducted within the WIPP Central Characterization Project (CCP).

A list of typical NDA methods or techniques is provided in Table A.8-1. Common NDA techniques rely on detection of gamma rays, neutrons, or heat generated by the waste. NDA is performed on a waste container basis.

RC will not be performed by CCP. If plans change, then RC will be performed in compliance with the requirements of the current WIPP-WAC, and this WCP will be revised.

Several regulations and criteria that apply to waste certification activities at WIPP require NDA data. The WIPP NDA program will perform assays, compile data and report data to supply the following:

- The quantities of radionuclides listed in section 3.3.1 of the WAC.
- The activity concentration of TRU radionuclides present in every waste container (nCi/g).
- Values for total alpha radioactivity and activities of individual radionuclides in individual containers to determine compliance with limits placed on individual containers for FGEs, PE-Ci, and decay heat.

For each CH-TRU waste container, the quantity of each specific radionuclide listed in section 3.3.1 will either be reported or a notation will be placed in the appropriate data field indicating absence of any listed radionuclide. Trace radionuclides (less than 5 percent of the total activity) need not be reported, so long as 95 percent of the total container’s radioactivity is accounted for. In the event that waste containers that have been radioassayed are overpacked (e.g., in an SWB), the individual activity values will be summed and divided by the net waste weight (total less container, shielding, and liner weights) to determine the container’s activity per gram.

Typically, NDA techniques do not directly identify and quantify all the individual radionuclides in TRU waste. Instead, they measure one or a few key radionuclides, which are then used in conjunction with data on isotopic ratios to calculate quantities of the unmeasured radionuclides. The CCP assay programs will establish or confirm isotopic ratios by direct measurement and these measured ratios will be used in conjunction with measured data to calculate WIPP-reportable values.

## A.2 Quality Assurance Objectives

The CCP NDA standard operating procedures (Table A.8-2) demonstrate and justify that the radioassay techniques used are appropriate for specific waste streams and/or TRUCON waste types being assayed. QAOs for radioassay are summarized in Table A-1. Compliance with these QAOs is determined by measurement of NIST-traceable standards in a non-interfering matrix. Further measurements involving measurement of NIST-traceable standards in surrogate wastes will also be conducted to establish waste form-specific Minimum Detectable Concentration (MDCs) and to provide measured data for input into estimates of Total Measurement Uncertainty (TMU).

The NDA QAOs have been established for precision and accuracy. CCP assay systems will demonstrate that the QAOs can be achieved for each radioassay system over the applicable ranges of measurement. The QAOs must be demonstrated on containers of the same nominal size as those in which the waste is assayed.

## A.3 Precision

CCP assay systems will demonstrate compliance with the QAO for precision by replicate processing of the appropriate-size waste container containing a noninterfering matrix and the quantities of TRU isotopes (or equivalent wattage) indicated in Table A-1 for each range for which the measurement system is to be qualified. PDP standards and containers with noninterfering matrices may be used after their characteristics have been published in a PDP test cycle report, if their use will not interfere with the PDP. The QAO radioactivity (or equivalent wattage) shall be placed in a noninterfering matrix and shall not be one of the standards used to calibrate the counting system. A total of either 6 or 15 replicate counts shall be obtained; the waste container shall be removed from the measurement system and reinserted between measurements. The calculated standard deviation of these measurements will be compared to the mean measured value of the QAO source to obtain the % relative standard deviation (%RSD).

## A.4 Accuracy

The CCP will demonstrate compliance with the QAO for accuracy by performing replicate measurements of a waste container of the appropriate size which contains a noninterfering matrix and the quantities of TRU isotopes (or equivalent wattage) indicated in Table A-1 for each range for which the measurement system is to be

qualified. Radioactivity in the QAO verification standards will be characterized as well as the calibration standards, however, it may not be one of the calibration standards and will not be derived from or calibrated against one of the calibration standards. PDP standards and containers with noninterfering matrices may be used to determine accuracy after their characteristics have been published in a PDP test cycle report, if their use will not interfere with the PDP. The activity shall be placed in a non-interfering matrix. A total of either 6 or 15 replicate counts shall be obtained; the waste container shall be removed from the measurement system and reinserted between measurements. The accuracy shall be computed as the mean percent recovery (%R) of the known value.

Table A-1
*Quality Assurance Objectives for Radioassay*

| **Range of Waste Activity in a-Curies[a]** | **Nominal Compliance Point a-Curies[b] (g WG Pu)[c] ((watts WG Pu))[d]** | **Precision (%RSD)[e]** | | **Accuracy (%R)[f]** |
|---|---|---|---|---|
| | | 6 replicates | 15 replicates | |
| 0 to 0.02 | 0.008<br>(0.1)<br>((0.0002)) | = 14 | = 20 | 70-130 |
| > 0.02 to 0.2 | 0.08<br>(1.0)<br>((0.002)) | = 10.5 | = 15 | 70-130 |
| > 0.2 to 2.0 | 0.8<br>(10)<br>((0.02)) | = 7 | = 10 | 70-130 |
| > 2.0 | 12.8<br>(160)<br>((0.4)) | = 3.5 | = 5 | 70-130 |

[a] Applicable range of TRU activity to which the QAOs apply, units are curies of alpha-emitting TRU isotopes with half-lives greater than 20 years.

[b] The nominal activity used to demonstrate compliance with the QAOs for the corresponding activity range in column 1. For purposes of demonstrating compliance with the QAOs, "nominal" means within ±50 percent.

[c] The nominal mass of weapons grade Pu (WG Pu) used to demonstrate compliance with the QAOs for the corresponding activity range in column 1. Values in single parentheses are the approximate equivalent masses of WG Pu (15 years after purification) corresponding to the nominal activity values shown. In the case of non-WG Pu isotopic mixtures, use nominal mass values based on the nominal activity values. For purposes of demonstrating compliance with the QAOs, "nominal" means with ± 50 percent.

[d] The nominal wattage of WG Pu used to demonstrate the compliance of calorimetric assay with the QAOs for the corresponding activity range in column 1. Values in double parentheses are the approximate equivalent wattages corresponding to the heat output from the nominal WG Pu mass values shown. In the case of non-WG Pu isotopic mixtures, use nominal wattage values based on the nominal mass values. For the purpose of demonstration with the QAOs, “nominal” means within ± 50 percent.

[e] ± One standard deviation based on either 6 or 15 replicate measurements of a noninterfering matrix. The choice of using either 6 or 15 replicate measurements for demonstrating compliance with these QAOs is at the discretion of the site or test facility; however, prior to performing these measurements, it is required that the site's or test facility's procedures explicitly identify the number of replicate measurements to be used for this determination. The calculated standard deviation is compared with the mean measured value of the QAO source to obtain the % RSD.

[f] Percent recovery (%R) determined from the ratio of measured to known values based on the average of either 6 or 15 replicate measurements of a noninterfering matrix. The choice of using either 6 or 15 replicate measurements for demonstrating compliance with these QAOs is at the discretion of the site or test facility; however, prior to performing these measurements, it is required that the site’s or test facility’s procedures explicitly identify the number of replicate measurements to be used for this determination. The QAO is the same irrespective of the number of replicates performed

## A.5 Relative Gamma Isotopic

### Ratio Analysis: Accuracy and Precision Requirements

Gamma isotopic ratio measurements do not provide absolute determinations for any TRU radionuclides. This method does determine the relative distribution of plutonium isotopes within the sample/container, information that is combined with other NDA primary methods to determine final reportable values. The CCP will demonstrate satisfactory performance for these systems, consistent with industry standard procedures, where applicable.

## A.6 Minimum Detectable Concentration (MDC)

The minimum detectable concentration (MDC) for each assay method will be determined, first in a non-interfering matrix and then for surrogate waste forms. The MDC is defined here as that radioactivity concentration which, if present, yields a measured value greater than the critical level with 95% probability, where the critical level is defined as that value which measurements of the background will exceed with 5% probability.

Typically, a “zero matrix” baseline detection limit will first be determined by performing either 6 or 15 replicate measurements on a surrogate waste container with a matrix containing no added activity. Using the measured variance of background thus obtained, the appropriate equations in References A1 or A2 can be used to calculate the baseline detection limit. To obtain a MDC applicable to waste form-specific containers, this detection limit is again determined by the same type background measurements of surrogate waste containers. CCP assay systems may find it more reasonable to use alternate methods of determining the MDC, and will do so, if deemed necessary, but will always use the definition of MDC described in the preceding paragraph. Only measured values greater than the waste form-specific MDC will be considered valid for TRU waste determinations. Waste for disposal at WIPP must contain a measured TRU alpha activity concentration of greater than 100 nCi/g, and only when the measured value is greater than the minimum detectable concentration.

## A.7 Total Measurement Uncertainty (TMU)

The method, including theories, calculations and test measurements, used to estimate TMU will be documented for each assay system. Although there are no applicable limits to TMU, each element of TMU will be identified for each assay system, and an estimated error will be compiled for each. The TMU reported will pertain only to measurements performed by the assay systems. Such elements as errors due to source manufacture, scale weights, AK or NDE will not be included in estimates of TMU.

Following is a list of items that typically contribute to the TMU. These will be evaluated for each assay system used by the CCP. The overall effects due to individual components listed below can be estimated by precision (random error) and bias (accuracy) determinations based on measurement of appropriate standards in surrogate wastes. This is the approach to TMU that will be used by the CCP.

- Random error
- Calibration uncertainties
- Non-uniform source distribution
- Self-shielding
- Self-absorption
- Attenuation
- Instrument-specific effects
- Inhomogeneous matrix effects
- Incorrect isotopic ratio assumption
- Gamma and neutron interfering materials
- Neutron multiplication

The estimate of TMU is an attempt to bound the potential range of uncertainty relative to the assay result. Principal components of TMU are precision, bias, and statistical errors from the measurements of isotopic ratio. Because these factors are impacted by waste matrix and source distribution, estimates of the bias and random error components will be determined by measurement of appropriate standards in surrogate waste containers. Errors due to isotopic composition will be propagated as generated by the software of the isotopic ratio measuring system.

### A.7.1 Assessment of Random Error Component of TMU

Random error (precision) is related to deviations of individual measurements from the true value. For NDA, counting statistics are generally the largest contributor to random error. Other factors contributing to random error are environmental (e.g., humidity, atmospheric pressure), instrumental (e.g., detector gain fluctuations), or container effects (e.g., movement of container contents). Over many measurements, random errors tend to cancel out. The random error component of TMU will be estimated by performing replicate assays of real or mocked-up waste containers, selected as representative of a waste stream or waste type, over the expected range of radioactivity.

### A.7.2 Assessment of Bias Component of TMU

The bias (accuracy) of an NDA system is defined as the ratio of an averaged NDA assay to the true value. If the ratio differs from 1, the system is biased with respect to that waste container. Biases occur due to the inherent difficulty of calibrating the system perfectly for every waste container, even within a specific waste stream. Factors contributing to bias vary according to the waste type, distribution of radioactivity, and radioassay method. Examples include matrix heterogeneity; waste components that absorb, moderate, attenuate, or multiply radioactive emissions; and nonuniform source distribution. The bias component of TMU will be estimated by performing replicate assays of mocked-up waste containers containing appropriate radionuclide standards, over the expected range of radioactivity.

### A.7.3 TMU Computation

The major components of TMU are random error, bias and isotopic ratio uncertainties. In rare instances, other components might be identified; if identified, the contribution of all such elements will be quantified and included in the TMU calculation. Due to isotopic ratio measurements, the uncertainty component changes depending on which reporting requirement is being addressed. It is assumed that the three major components are independent, i.e., not correlated; hence they will be added in quadrature, as recommended in Reference A13.

The CCP will document how the individual elements of uncertainty are determined and how they are combined to calculate the TMU. Compliance with these requirements will be evaluated in reviews of the TMU package for each assay system by an NDA technical specialist with assistance, as needed, from other CBFO staff members who have appropriate technical and practical experience.

CCP TMU estimates will be used by the CCP to: 1) help determine validity of CCP assay results. 2) establish (mobile vendors) or verify (fingerprinting assays performed at WIPP) compliance with WIPP reporting requirements for FGE (adding two TMU values to the assay result for FGE reporting, and adding one TMU value for decay heat).

## A.8 NDA Methods Requirements

Various NDA assay methods (Table A.8-1) are available to achieve the applicable QAOs and other requirements. The list is neither complete nor limiting and is simply intended to illustrate the breadth of choices. Assay systems to be used by the CCP will be selected from the list. CCP procedures to implement the NDA assay methods are listed in Table A.8-2

The CCP uses both neutron and gamma detecting assay systems. Adequate instrumentation will be provided to perform assays of any TRU waste form and any container that meets WIPP-WAC container specifications.

For NDA, the assay procedures cited in various American Society for Testing and Materials (ASTM) standards (References A3-A6) and NRC standard practices and guidelines (Reference A7) as referenced in this appendix are recommended for use at testing facilities. For calorimeters, American National Standards Institute (ANSI) and ASTM standards cited in references A14 through A16 will serve as guidance from which to prepare operating and calibrating procedures. These procedures specify the use of NIST-traceable calibration standards, compatible equipment and equipment setup, record keeping, equipment maintenance, and safe operation of the equipment.

**Table A.8-1**
**Typical NDA Methods**

| Types of Measurements | **Methods** |
|---|---|
| **Gamma-ray measurements** | High resolution spectroscopy (intrinsic germanium)<br>**Transmission corrected gamma-ray measurements**<br>- **Segmented gamma-ray scanner**<br>- **Computed tomographic gamma-ray scanner**<br>- **Relative gamma spectrum isotopic analysis** |
| **Passive neutron measurements** | **Shielded neutron assay probe totals counter**<br>**Passive neutron coincidence counter**<br>**Advanced matrix corrected passive neutron counter**<br>**High efficiency neutron counter**<br>**May utilize relative gamma spectrum isotopic analysis methods ($^{240}Pu_{effective}$).** |
| **Calorimetric assay** | **Combination of heat flow calorimetry and relative gamma spectrum isotopic analysis methods ($P_{eff}$).** |
| **Passive/active neutron measurements** | Am-Li source-driven coincidence counter<br>**Californium delayed-neutron counter (shuffler)**<br>**Neutron generator differential die-away counter**<br>**Combined thermal/epithermal neutron counter**<br>**May utilize relative gamma spectrum isotopic analysis methods ($^{240}Pu_{effective}$).** |

**Table A.8-2**
**NDA Procedures**

| Column Title | Procedure Title |
|---|---|
| CCP APNEA Waste Drum Assay Procedure | CCP-TP-016 |
| CCP APNEA Data Analysis | CCP-TP-017 |
| CCP APNEA Batch Drum Report Procedure | CCP-TP-021 |
| CCP Mobile IPAN/GEA Maintenance Procedure | CCP-TP-022 |
| CCP Mobile IPAN/GEA System Mobilization, Power Up, and Demobilization Procedure | CCP-TP-023 |
| CCP Mobile IPAN/GEA Operating and Data Generation Level Validation Procedure | CCP-TP-024 |
| CCP Mobile IPAN/GEA Expert Analysis Procedure | CCP-TP-025 |
| CCP IPAN/GEA Calibration Procedure | CCP-TP-026 |
| CCP WIT Nondestructive Assay | CCP-TP-036 |

## A.9 Quality Control

To ensure that data of known and documented quality are generated, the CCP will implement a documented facility QA program that specifies qualitative and quantitative acceptance criteria for the QC checks of this program and corrective action measures to be taken when these criteria are not satisfied.

The CCP Facility QA officer will monitor and document compliance with the provisions of the QA program, including procedure performance and analysis of QC samples. A nonconformance report (NCR) will be initiated as specified when QA/QC data, or information, do not meet specific QA/QC requirements. Actions taken to resolve NCRs will be tracked and documented. The CCP Facility QA officer and NDA technical supervisor will have the responsibility to implement corrective actions when procedure performance is not acceptable.

Calibration and operating procedures will be prepared and approved as necessary prior to initiation of assays of record. The CCP will ensure currency of procedures in accordance with the CBFO-QAPD and CCP-QP-007, *CCP Document Control* and CCP-QP-010, *CCP Document Preparation and Approval*.

### A.9.1 Background Measurements

Background measurements will be performed daily, unless otherwise specified in approved radioassay system procedures and supported by applicable consensus standards or other technical justification.

### A.9.2 Instrument Performance Checks

Performance checks on NDA instruments will be performed daily on calibrated and operable radioassay systems before use on that day; additional checks at other times may be performed as necessary. Radioactive standards used for these checks are not required to be NIST traceable; however, they will be well characterized with regard to their radionuclide content, long-lived, easy to position relative to the detector(s), and of sufficient radioactivity to obtain statistically sufficient results in relatively short count times. Performance checks will include efficiency checks and, for spectrometric instruments, energy calibration and resolution checks. Performance checks for calorimetry will be performed at frequencies consistent with applicable consensus standards.

### A.9.3 Control Charts

Background or baseline measurements and other performance checks will be plotted on applicable control charts to demonstrate continued acceptability of the assay system. Control charts will contain two levels of concern; a warning level that requires an additional background or performance check, and, an action level that requires further investigation before the system can be used up to and including additional checks and a removal of the instrument from service. If performance checks result in data that are outside the acceptable range, the radioassay system will be removed from service pending completion of corrective actions. In the latter situation, all assays performed since the last acceptable performance check will be considered suspect, pending satisfactory resolution.

### A.9.4 Replicate Assays

The CCP will perform replicate assays once per testing batch (defined as no more than 20 containers) or once per week, whichever is more frequent, except for calorimetric assay, where replicate assays will be performed once per testing batch (defined as no more than 20 containers), or once per month, whichever is more frequent.

### A.9.5 Comparison Programs

All applicable CCP assay systems participate in the NDA Performance Demonstration Program (PDP).

### A.9.6 Radioassay Operator Training

Only trained personnel will perform radioassays. Standardized training requirements for radioassay operators will be based on existing industry standard training requirements and the DOE-CBFO QAPD. Training and qualification is administered in accordance with CCP-QP-002, *CCP Training and Qualification Plan*. Requalification of operators will be based on evidence of continued satisfactory performance and CCP-QP-002, *CCP Training and Qualification Plan.*

## A.10 Calibration Procedures and Frequencies

Each NDA system operated by the CCP will be calibrated before initial use. Calibration will be verified by performance of at least one matrix/radioactive source combination at least annually. Unless the NDA system is limited to assay of only one waste form, the same source/matrix combination will not be used repeatedly to satisfy the latter requirement. Written calibration procedures that address applicable calibration requirements of Section A will be prepared for each NDA system. For calorimetric assay, Reference A9 should be used as a source of calibration requirements. Full documentation of the calibration technique, including measured data, will be prepared. Recalibrations will be performed, after major repairs, persistence of out of control background and/or performance checks, or if calibration verification activities demonstrate that an NDA system has significantly changed response. Isotopic ratio measurement systems need to be calibrated for energy only, which will be performed in compliance with applicable consensus standards, when available.

Primary calibration standards will be traceable to or obtained from NIST or the New Brunswick Laboratory. If primary standards are not available, the standards used will be cross-calibrated with primary standards obtained from the above sources. PDP standards and surrogate waste containers will not be used for calibration since the calibration sources must be independent from sources used for verification measurements (i.e., the PDP). The range of applicability of system calibration or calibration verification will be specified in CCP procedures, as will the applicable waste types or relevant waste matrix characteristics (e.g., densities, moderator content) for which the calibrations are valid.

## A.11 Software Requirements

All computer programs and revisions thereof used for radioassay will be documented, verified, and validated as required by the QAPD (Reference A10). Verification will include both verification of the algorithms used and verification test measurements that compare program outputs to true values. Test measurements will include default and boundary values of parameters. Performance of software controlling the measurement process and analyzing data will be demonstrated and documented in accordance with ASME NQA-1, element 11, supplement 11S-2 (Reference A11) and NQA-2, part 2.7

(Reference A12). Performance of software will be demonstrated either by the use of test problems or by test measurements of QC radioactivity standards. The software will be tested over the full, expected range of assay.

Documentation of computer software will include, at a minimum:

- Program name
- Revision number
- Revision date
- Author(s)
- Program application
- Programming language (including version numbers of compilers, linkers, etc.)
- Operating system
- Required hardware
- Descriptions of algorithms used
- User's manual
- Listing of code
- Examples of input and output forms
- Results of test cases
- Copies of external data files
- Lists of default parameters
- Records of review and approval

CCP operating procedures for radioassay systems will contain instructions for the operation of computerized systems.

If radioassay data are to be reduced using computer software that is specifically designed for the particular method used, the software will be identified in the operating procedures. Algorithms associated with each NDA system will be described in instrument-specific technical documents and data outputs will be collected and retained. Data will be electronically transferred whenever possible.

## A.12 Data Management

NDA results for each waste container will be documented and available to project staff. Requirements for data validation and reporting are presented below.

### A.12.1 Data Validation

Radioassay data will be reviewed and approved by qualified personnel prior to being reported. The validation process will include verification that the QAOs in Table A-1 have been met. Demonstration of QAO compliance will be limited to the ranges in Table A-1 for which the assay system will actually be used.

### A.12.2 Data Reporting

NDA results will be documented and available to data users. Raw data will be retained in sufficient detail such that critical calculations can be repeated, if necessary. If activities of isotopes other than the nominal isotopes of interest are detected by an actual waste measurement, the activity of each isotope must be reported as part of the waste assay for that container.

NDA data will be reported on a testing batch basis. For purposes of the program, batches are defined as a suite of waste containers being assayed by the same testing equipment. A testing batch is defined as up to 20 waste containers without regard to waste matrix.

Testing batch data will be prepared and submitted for each NDA system operated by the CCP, and submitted to the SPQAO on approved standard forms (or electronic equivalent). Procedures will include examples of testing batch forms (or electronic equivalent) that will be used for reporting. Radioassay testing batch data reports will contain the following:

- Testing facility name, testing batch number, container numbers included in that testing batch and signature releases of radioassay testing personnel as described in section B3-10 of the WAP.
- Table of contents.
- Background and performance check data or control charts for the relevant time period.
- Data review checklists for each testing batch verifying that the data generation level review as described in section B3-10 of the WAP has taken place.
- Separate testing report sheet(s) for each container sample in the testing batch that includes
  - Title "Radioassay Data Sheet"
  - Method used for NDA (i.e., procedure identification)
  - TRUCON code, Item Description Code, matrix parameter category, as applicable
  - Date of NDA examination

- Total $^{239}$Pu FGEs (g) and associated uncertainty
- Total alpha activity and associated uncertainty (curies)
- TRU activity and associated uncertainty (nCi/g)
- Listing of individual radioisotopes present (curies) and associated uncertainty (curies)
- Thermal power and associated uncertainty (W)
- QC replicate (yes/no)
- Operator signature/date
- Reviewer signature/date

All associated uncertainties will be reported at both one and two standard deviations (67% and 95% confidence). TMU will be calculated as described in Section A.7. Reported data will contain the required information and will be signed by appropriate personnel as required. In addition, the following items will be maintained in CCP files, and will be documented and retrievable by testing batch number:

- Applicable raw data, including instrument readouts, calculation records, and radioassay QC results
- All instrument calibration reports, as applicable

Contract radioassay testing facilities shall forward these items along with testing batch data reports to the site project office for storage in site project files. As with batch data reports, these items may be submitted in electronic format.

## References for Appendix A

A1 Currie, Lloyd A., 1968. Limits for qualitative detection and quantitative determination. *Anal. Chem.* 40: 586-93.

A2 EPA, 1980. *Upgrading Environmental Radiation Data.* EPA 520/1-80-012, Washington D. C., Office of Radiation Programs, U. S. Environmental Protection Agency.

A3 American Society for Testing and Materials. "Standard Test Method for Determination of Plutonium Isotopic Composition by Gamma-Ray Spectrometry." ASTM C1030-95, Annual Book of ASTM Standards, Philadelphia, Pennsylvania, American Society for Testing and Materials.

A4 American Society for Testing and Materials. "Standard Test Method for Nondestructive Assay of Nuclear Material in Scrap and Waste by Passive-Active Neutron Counting Using a 252Cf Shuffler." ASTM C1316-95, Philadelphia, Pennsylvania, American Society for Testing and Materials.

A5 American Society for Testing and Materials. "Standard Test Method for Nondestructive Assay of Special Nuclear Material in Low Density Scrap and Waste by Segmented Passive Gamma-Ray Scanning." ASTM C1133-96, Annual Book of ASTM Standards, Philadelphia, Pennsylvania, American Society for Testing and Materials.

A6 American Society for Testing and Materials, “Standard Test Method for Nondestructive Assay of Plutonium, Tritium and 241Am by Calorimetric Assay.” ASTM C-1458-00, Annual Book of ASTM Standards, Philadelphia, PA, American Society for Testing and Materials.

A7 U.S. Nuclear Regulatory Commission. 1984. *Nondestructive Assay of Special Nuclear Material Contained in Scrap and Waste.* Regulatory Guide 5.11, Washington, DC, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission.

A8 U.S. Department of Energy. 2001. *Performance Demonstration Program Plan for Nondestructive Assay of Drummed Wastes for the TRU Waste Characterization Program.* DOE/CBFO-01-1005, Current Revision. Carlsbad, New Mexico, Carlsbad Area Office, U.S. Department of Energy.

A9. American National Standard for Nuclear Materials. *Plutonium-Bearing Solids Calibration Techniques for Calorimetric Assay.* ANSI N15.22-1987.

A10 U.S. Department of Energy. *Quality Assurance Program Document.* CAO-94-1012. Carlsbad, New Mexico, Carlsbad Area Office, U.S. Department of Energy.

A11 ASME NQA-1-1989. *Quality Assurance Program Requirements for Nuclear Facilities.*

A12 ASME NQA-2a-1990 addenda, Part 2.7 *Quality Assurance Requirements of Computer Software for Nuclear Facility Applications.*

A13 Smith, K. C., R. A. Stroud, K. L. Coop, and J. F. Bresson. 1998. "Total measurement uncertainty assessment for transuranic waste shipments to the Waste Isolation Pilot Plant." Proceedings of the 6th Nondestructive Assay Waste Characterization Conference, Salt Lake City, Nov. 17-19, 1998, pp.21-37.

A14 American Society for Testing and Materials (ASTM). "Standard Test Method for Nondestructive Assay of Plutonium, Tritium and $^{241}$Am by Calorimetric Assay." ASTM C1458-00.

A15 American National Standards Institute, American National Standard for Nuclear Materials-Plutonium-bearing Solids Calibration Techniques for Calorimetric Assay (ANSI N16.22-1987).

A16 American Society for Testing and Materials (ASTM), Standard Test Method for Determination of Plutonium Isotopic Composition by Gamma Ray Spectrometry (C 1030-95).

## Acronyms and Abbreviations

| | |
|---|---|
| AK | Acceptable Knowledge |
| ASME | American Society of Mechanical Engineers |
| ASTM | American Society for Testing and Materials |
| CBFO | Carlsbad Field Office |
| CAR | corrective action report |
| CCP | Central Characterization Project |
| CFR | *Code of Federal Regulations* |
| CH | contact-handled |
| CH TRU | contact-handled transuranic |
| DOD | U.S. Department of Defense |
| DOE | U.S. Department of Energy |
| DOT | U.S. Department of Transportation |
| dpm | disintegration(s) per minute |
| DQO | data quality objective |
| EPA | U.S. Environmental Protection Agency |
| EM-1 | Assistant Secretary for Environmental Management |
| FGE | fissile gram equivalent |
| LDR | land disposal restriction |
| mrem/hr | milliroentgen(s) equivalent man per hour |
| NIST | National Institute of Standards and Technology |
| nCi/g | nanocurie(s) per gram |
| NCR | nonconformance report |
| NDA | nondestructive assay |
| NDE | nondestructive examination |
| NFT | Nuclear Filter Technology |
| NMED | New Mexico Environment Department |
| NRC | U.S. Nuclear Regulatory Commission |
| NTP | National TRU Program |
| NTWCT | National TRU Waste Certification Team |
| PATCD | *Payload Assembly Transportation Certification Document* |
| PCB | polychlorinated biphenyl |
| PCTCD | *Payload Container Transportation Certification Document* |
| PDP | Performance Demonstration Program |
| PE-Ci | plutonium-239 ($^{239}$Pu ) equivalent-curie(s) |
| QA | quality assurance |
| QAO | quality assurance objective |
| QAPD | *Quality Assurance Program Document* |
| QAPD Procedures Matrix | *CCP Quality Assurance Program Document Procedures Matrix* |
| QAPjP | *CCP Transuranic Waste Characterization Quality Assurance Project Plan* |
| QC | quality control |
| RCRA | Resource Conservation and Recovery Act |

| | |
|---|---|
| RCT | radiological control technician |
| RH | remote-handled |
| RMS | root mean square |
| SAR | safety analysis report |
| SPM | site project manager |
| SPQAO | site project quality assurance officer |
| SW-846 | *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* |
| SWB | standard waste box |
| TC | toxicity characteristic |
| TCO | Transportation Certification Official |
| TDOP | ten-drum overpack |
| TRAMPAC | *TRUPACT-II Authorized Methods for Payload Control* (Appendix 1.3.7 of TRUPACT-II SARP) |
| TRU | transuranic |
| TRUCON | *TRUPACT-II Content Codes* |
| TRUPACT-II | Transuranic Package Transporter-II |
| TRUPACT-II SARP | *Safety Analysis Report for the TRUPACT-II Shipping Package* |
| UHWM | Uniform Hazardous Waste Manifest |
| VOC | volatile organic compound |
| WAC | waste acceptance criteria |
| WAP | *Waste Analysis Plan* (Attachment B of WIPP Hazardous Waste Facility Permit) |
| WCO | Waste Certification Official |
| WCP | *CCP Transuranic Waste Certification Plan* |
| WIPP | Waste Isolation Pilot Plant |
| WIPP SAR | *Waste Isolation Pilot Plant Safety Analysis Report* |
| WIPP WAC | *Waste Acceptance Criteria for the Waste Isolation Pilot Plant* |
| WSPF | *Waste Stream Profile Form* |
| WWIS | Waste Isolation Pilot Plant Waste Information System |